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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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VOLUME 24 NUMBER 12 / JUNE 23, 1986

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

01 AERONAUTICS (GENERAL) 1895

02 AERODYNAMICS 1895
Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.
For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 1899
Includes passenger and cargo air transport operations; and aircraft accidents.
For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1900
Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.
For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1900
Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

06 AIRCRAFT INSTRUMENTATION 1902
Includes cockpit and cabin display devices; and flight instruments.
For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 1902
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.
For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 1903
Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1904
Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.
For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 1905
For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS N.A.
Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.
Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.
For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES 1906
Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION N.A.
Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.
For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

17 SPACECRAFT COMMUNICATION, COMMAND AND TRACKING 1906
Includes telemetry; space communications networks; astronavigation; and radio blackout.
For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1907
Includes spacecraft thermal and environmental control; and attitude control.
For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

19 SPACECRAFT INSTRUMENTATION 1908
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER 1909
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **1909**
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **1911**
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **1917**
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS **1921**
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **1925**
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **1930**
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) **1932**
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **1933**
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING **1936**
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuity.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER **1943**
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY **1947**
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS **1952**
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **1954**
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **1958**
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **1958**
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES **1972**
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION **1974**
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION **1978**
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS **1980**
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY **1986**
Includes weather forecasting and modification.

48 OCEANOGRAPHY **1988**
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) **1990**
Includes genetics.

52 AEROSPACE MEDICINE **1992**
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES **1994**
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT **1995**
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY **N.A.**
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) **1996**

60 COMPUTER OPERATIONS AND HARDWARE **1997**
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE **2000**
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS **2007**
Includes computer networks.

63 CYBERNETICS **2007**
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS **2009**
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY **2013**
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS **2016**
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS **2016**
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) **2017**
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS **2024**
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS **2026**
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS **2028**
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS **2039**
Includes light phenomena.

75 PLASMA PHYSICS **2042**
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS **2045**
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS **2048**
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) **N.A.**
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT **2048**
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE **2050**
Includes information storage and retrieval technology; micrography; and library science.
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83 ECONOMICS AND COST ANALYSIS **2050**
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85 URBAN TECHNOLOGY AND TRANSPORTATION **2051**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) **2051**

89 ASTRONOMY **2052**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS **2058**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION **2059**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **2062**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **2062**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

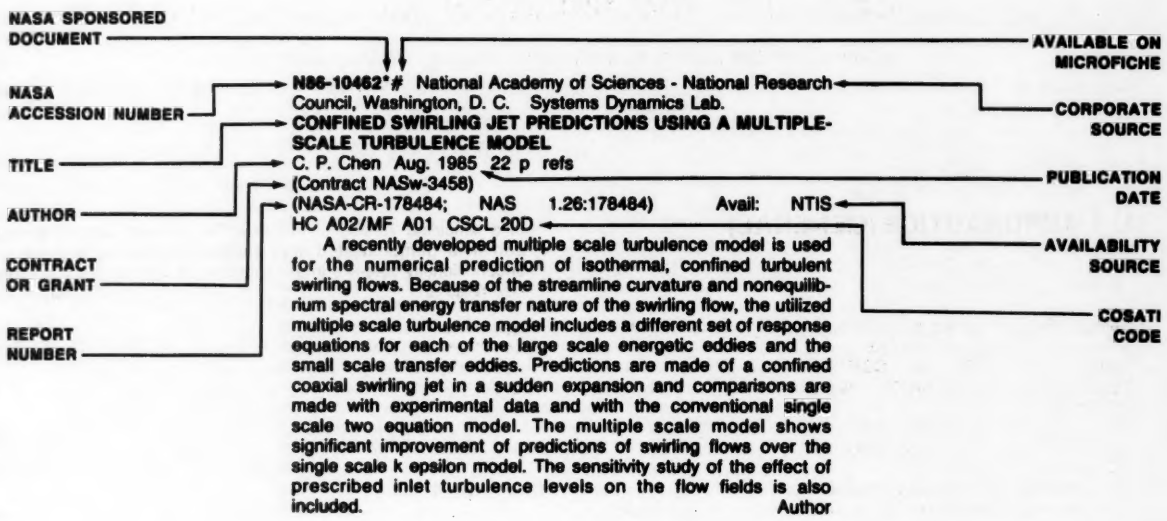
GENERAL

99 GENERAL **N.A.**

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX **I-1**
PERSONAL AUTHOR INDEX **I-67**
CORPORATE SOURCE INDEX **I-75**
CONTRACT NUMBER INDEX **I-89**
REPORT/ACCESSION NUMBER INDEX **I-93**

TYPICAL CITATION AND ABSTRACT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CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
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(Contract NASw-3458)
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(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
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HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N86-21500# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
DEVELOPMENT OF A COMPUTERISED METHOD OF DETERMINING AIRCRAFT MAINTENANCE INTERVALS M.S. Thesis
David B. OHearn Sep. 1985 102 p
(AD-A161339; AFIT/GLM/LSM/85S-59) Avail: NTIS HC A06/MF A01 CSCL 05/1

Scheduled maintenance is considered one of the largest costs of aircraft ownership. For some components that exhibit an increasing failure rate, this cost can be minimized by changing the components at their optimal age replacement intervals which can be determined using the Total-Time-on-Test statistic. However, the age replacement model treats all components as separate entities and does not recognize economies that can be achieved by changing groups of components at the same time. This study develops a heuristic model for determination of near optimal groupings of components and the replacement intervals for these components. This heuristic model is illustrated using actual field data for a number of components fitted to the C130H aircraft engines operated by the Royal Australian Air Force. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-21501 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A NEW PARABOLIZED NAVIER-STOKES SCHEME FOR HYPERSONIC REENTRY FLOWS Ph.D. Thesis
Bilal A. Bhutta 1985 173 p
Avail: Univ. Microfilms Order No. DA8521297

High Mach number, low-Reynolds number (high-altitude) reentry flowfield predictions are an important problem area in computational aerothermodynamics. Available numerical tools for handling such flows are very few and significantly limited in their applicability. A new implicit fully-iterative Parabolized Navier-Stokes (PNS) scheme is developed to accurately predict such low-Reynolds number flows. In the new approach the differential equations governing the conservation of mass, momentum and energy, and the algebraic equation of state for a perfect gas are solved simultaneously in a coupled manner. The idea is presented that by treating the governing equations in this manner (rather than eliminating the pressure terms in the governing equations by using appropriate differentiated forms of the equation of state) it may be possible to have an unconditionally time-like numerical scheme. The stability of a simplified version of this new PNS scheme is also studied, and it is demonstrated that these simplified equations are unconditionally time-like in the subsonic as well as the supersonic flow regions. Dissert. Abstr.

N86-21502 Colorado Univ., Boulder.
VORTICAL FLOWS ABOUT OSCILLATING AIRFOIL WITH SURFACE SUCTION Ph.D. Thesis
Chyn-Shan Chiu 1985 94 p
Avail: Univ. Microfilms Order No. DA8522651

The motion of discrete vortices in the vicinity of an oscillating Joukowski airfoil with surface suction and the influence of these vortices on the aerodynamic performance of the airfoil are studied using the method of conformal mapping in combination with a numerical technique. The following four cases are examined: (1) discrete vortices are released intermittently from the upper surface of the airfoil causing the mean lift to increase and approach an symptotic value as time increases while the mean drag decreases monotonically. The oscillating moment always lags behind the airfoil motion and the behavior of its mean value is similar to that of the lift; (2) a trapped vortex is perturbed by a finite distance away from its equilibrium position and is found to be generally unstable to the finite disturbances; (3) a free vortex is released at a location upstream of the airfoil and moves towards the trailing edge with its trajectory being affected by the geometry of the airfoil; and (4) a free vortex can be made to linger above the oscillating airfoil for a long period of time provided a proper suction is applied to the upper surface. Dissert. Abstr.

N86-21503 California Inst. of Tech., Pasadena.
EXPERIMENTS ON ENTRAINMENT, MIXING AND CHEMICAL REACTIONS IN TURBULENT JETS AT LARGE SCHMIDT NUMBER Ph.D. Thesis
Werner Johann Anton Dahm 1985 182 p
Avail: Univ. Microfilms Order No. DA8522608

Entrainment, mixing and chemical reactions are investigated in the far field of a steady, axisymmetric, momentum-driven, turbulent jet issuing into an unconfined, quiescent medium in the large Schmidt number (liquid-phase) regime. Visualization experiments using both passive and chemically-sensitive laser induced fluorescence (LIF) techniques show the important role of large scale transport in the jet far field, and show that entrainment, mixing and chemical reactions in the far field are dominated by a large scale organization of the flow. Consecutive instantaneous profiles of the jet fluid concentration along the axial and radial directions in the far field are measured by combining these LIF techniques with direct high-resolution linear photodiode array imaging and high speed digital data acquisition. These axial imaging measurements have revealed a similarity concentration variable in the jet far field for which probability density functions (PDFs) display self-similarity along rays in the jet. Dissert. Abstr.

N86-21504 Maryland Univ., College Park.
COMPUTATION OF THREE DIMENSIONAL POTENTIAL FLOW AROUND A FINITE WING WITH A LEADING-EDGE DISCONTINUITY AT HIGH ANGLE OF ATTACK Ph.D. Thesis

Taehwan Cho 1985 219 p
Avail: Univ. Microfilms Order No. DA8523059

The aerodynamics of a finite wing above the stall angle of attack is investigated computationally. Vortex panel computer programs have been developed which can be used to calculate two dimensional separated flows over airfoils and three dimensional separated flow over a wing with leading edge droop modification. On each wind surface panel, a bound vortex is assumed to be distributed linearly in the spanwise direction and also in the chordwise direction. For the three dimensional flow around a finite thickness wing, the upper and lower surfaces are assumed to be independent infinitely thin wings located on top of each other. For three dimensional separated flow calculations, two different computational models are developed. One is a semi-empirical engineering model which is applied to an infinitely thin wing. The location of the separation and the pressure inside the separation region are provided from experiment. Inside the separation region, constant strength vortex panels are distributed corresponding to the constant pressure, Cp = -0.6, which is confirmed by various experiments. Dissert. Abstr.

N86-21505*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF A LINEARIZED UNSTEADY AERODYNAMIC ANALYSIS TO STANDARD CASCADE CONFIGURATIONS Final Report

Joseph M. Verdon and William J. Usab, Jr. Washington NASA Jan. 1986 56 p refs
(Contract NAS3-22257)
(NASA-CR-3940; R85-956896-4; E-2686; NAS 1.26:3940) Avail: NTIS HC A04/MF A01 CSCL 01A

A linearized potential flow analysis, which accounts for the effects of nonuniform steady flow phenomena on the linearized unsteady aerodynamic response to prescribed blade motions, has been applied to five cascade configurations. These include the first, fifth, eighth and ninth standard configurations proposed as a result of the Second International Symposium on Aeroelasticity in Turbomachines and a NASA Lewis flutter cascade. Selected results from this study, including comparisons between analytical predictions and the experimental measurements submitted for three of the foregoing configurations, are described. The correlation between theory and experiment for the first standard configuration (a compressor cascade operating at low Mach number and frequency) is quite good. Moreover, the predictions and measurements for the NASA Lewis cascade of symmetric biconvex airfoils show good qualitative agreement. However, wide discrepancies exist between the theoretical predictions and the experimental measurements for the fifth standard configuration (a subsonic transonic fan tip cascade). These can be partially attributed to conditions being imposed in the experiment which differ from those commonly used in unsteady aerodynamic analyses. Author

N86-21506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ANALYSIS OF JIMSPHERE PAIRS FOR USE IN ASSESSING SPACE VEHICLE ASCENT CAPABILITY

Charles K. Hill Mar. 1986 113 p refs
(NASA-TP-2573; NAS 1.60:2573) Avail: NTIS HC A06/MF A01 CSCL 01A

A data base of paired detailed wind profiles was developed for use in evaluating Shuttle Transportation System (STS) ascent capability. Since launch decision is based on a wind measured about 3.5 hr before launch, a data base of paired detailed profiles is needed. Method and technique on the reduction process and analysis is also presented. Guidelines used in selecting the pairs of profiles were established to insure a valid and representative data base. Sigma-U values for 3.5 hr at 12 km altitude show 8 percent increase from the transition case to the winter case and 18 percent decrease from the transition case to the summer case. Sigma-Values for 3.5 hr at 12 km altitude shows 12 percent increase from the transition case to the winter case and 17 percent decrease from the transition case to the summer case. A special feature of the 7- and 10.5-hr cases is that sigma-V increases by as much as 30 percent from the transition to the winter profiles. This large increase does not appear in the sigma-U data. Comparisons of the calculated values of 3.5 hr standard deviations of U and V with actual component deviations measured during space shuttle launch conditions confirm that the statistical values are representative. Author

N86-21507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INVESTIGATION OF SOLID PLUME SIMULATION CRITERIA TO PRODUCE FLIGHT PLUME EFFECTS ON MULTIBODY CONFIGURATION IN WIND TUNNEL TESTS

Alonao L. Frost and Charlie C. Dill Mar. 1986 182 p
(NASA-TP-2569; NAS 1.60:2569) Avail: NTIS HC A09/MF A01 CSCL 01A

An investigation to determine the sensitivity of the space shuttle base and forebody aerodynamics to the size and shape of various solid plume simulators was conducted. Families of cones of varying angle and base diameter, at various axial positions behind a Space Shuttle launch vehicle model, were wind tunnel tested. This parametric evaluation yielded base pressure and force coefficient data which indicated that solid plume simulators are an inexpensive, quick method of approximating the effect of engine exhaust plumes on the base and forebody aerodynamics of future, complex multibody launch vehicles. Author

N86-21508# National Aerospace Lab., Tokyo (Japan).

A VISCOUS-INVISCID INTERACTION METHOD TO PREDICT THE AERODYNAMIC PERFORMANCE OF AIRFOILS AT TRANSONIC SPEED

Kenichi Masuno 1985 34 p refs In JAPANESE; ENGLISH summary
(NAL-TR-873) Avail: NTIS HC A03/MF A01

The present paper describes a calculation method for predicting the aerodynamic performance of single airfoils in the transonic flows of high Reynolds numbers. For the inviscid part of the method, a transonic full potential equation represented on an algebraically generated C-topology coordinate system is solved by a fully conservative AF2 iteration scheme. A finite difference method (PC-CN Scheme) is used for the boundary layer and wake solutions. In the viscous method, an algebraic turbulence model for the asymmetric near wake is also developed. The model used to achieve viscous-inviscid coupling is the equivalent source model. The wake thickness and curvature are taken into account. The calculations for turbulent wake flows indicated good agreement with the experimental data, and show that the velocity profiles across the wake and minimum velocities can be computed satisfactorily with the present method. Comparisons of the predictions with high Reynolds number wind tunnel experiments show good agreement for pressure distributions, lift and drag. Author

N86-21509*# National Aeronautics and Space Administration, Washington, D.C.

COMPARISON OF COMPUTATIONAL RESULTS OF A FEW REPRESENTATIVE THREE-DIMENSIONAL TRANSONIC POTENTIAL FLOW ANALYSIS PROGRAMS

K. Tanaka and H. Hirose Jan. 1986 19 p refs Transl. into ENGLISH of "Sanjigen Sen-Onsokunagare Kaisetsu Kakashu Puroguramu Niyoru Keisankekka no Hikaku" presented at the NAL Symposium on Aircraft Computational Aerodynamics, 1983 p 157-167 Symposium held in Tokyo, Japan, 30 Jun. - 1 Jul. 1983 Original language document was announced as N85-26628 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77963; NAS 1.15:77963) Avail: NTIS HC A02/MF A01 CSCL 01A

The development of transonic aerodynamic computation methods and specific examples, as well as examples of three-dimensional transonic computation in design, are discussed. The case of the transonic transport and the case of the small transport are analyzed. Requirements for programs of the future are itemized. Author

N86-21510*# National Aeronautics and Space Administration, Washington, D.C.
VORTEX CONCEPTION OF ROTOR AND MUTUAL EFFECT OF SCREW/PROPELLERS
A. M. Lepilkin Jan. 1986 48 p refs Transl. into ENGLISH from Bulletin of the Academy of Sciences USSR, Mechanics and Machine Building (USSR), no. 5, 1963 p 77-107 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77979; NAS 1.15:77979) Avail: NTIS HC A03/MF A01 CSCL 01A

A vortex theory of screw/propellers with variable circulation according to the blade and its azimuth is proposed, the problem is formulated and circulation is expanded in a Fourier series. Equations are given for inductive velocities in space for crews, including those with an infinitely large number of blades and expansion of the inductive velocity by blade azimuth of a second screw. Multiparameter improper integrals are given as a combination of elliptical integrals and elementary functions, and it is shown how to reduce elliptical integrals of the third kind with a complex parameter to integrals with a real parameter. Author

N86-21511*# National Aeronautics and Space Administration, Washington, D.C.
PROPULSION AND CONTROL PROPELLERS WITH THRUSTER NOZZLES PRIMARILY FOR AIRCRAFT APPLICATIONS
W. Pabst Mar. 1986 8 p Transl. into ENGLISH of West German Patent no. P3440369.8 (5 Nov. 1984) p 1-6 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77715; NAS 1.15:77715) Avail: NTIS HC A02/MF A01 CSCL 01A

A propulsion and control propeller with thruster nozzles, primarily for aircraft application is described. Adjustability of rotor blades at the hub and pressurized gas expulsion combined with an air propeller increase power. Both characteristics are combined in one simple device, and, furthermore, incorporate overall aircraft control so that mechanisms which govern lateral and horizontal movement become superfluous. Author

N86-21512*# National Aeronautics and Space Administration, Washington, D.C.
MUTUAL EFFECT OF THERMOCHEMICAL SURFACE DECOMPOSITION AND VISCOUS INTERACTION DURING HYPERSONIC FLOW PAST A SHARP CONE
A. V. Limanskiy and V. I. Timoshenko Feb. 1986 11 p refs Transl. into ENGLISH from Kosmicheskiye Issledovaniya na Ukraine (USSR), no. 11, 1977 p 23-26 Original language document was announced in IAA as A78-53508 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-78015; NAS 1.15:78015) Avail: NTIS HC A02/MF A01 CSCL 01A

Numerical results on the hypersonic gas flow in viscous interaction regime past sharp circular cones with thermally destructible Teflon surface are presented. Characteristics of the mutual influence between the thermochemical decomposition of the surface and the viscous interaction are revealed. Author

N86-21513*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE PREDICTED EFFECT OF AERODYNAMIC DETUNING ON COUPLED BENDING-TORSION UNSTALLED SUPERSONIC FLUTTER
Daniel Hoyniak and Sanford Fleeter [1986] 30 p refs Prepared for presentation at the 31st International Gas Turbine Conference, Dusseldorf, West Germany, 8-12 Jun. 1986; sponsored by ASME Prepared in cooperation with Purdue Univ., West Lafayette, Ind.
(NASA-TM-87240; E-2915; NAS 1.15:87240) Avail: NTIS HC A03/MF A01 CSCL 01A

A mathematical model is developed to predict the enhanced coupled bending-torsion unstalled supersonic flutter stability due to alternate circumferential spacing aerodynamic detuning of a turbomachine rotor. The translational and torsional unsteady aerodynamic coefficients are developed in terms of influence coefficients, with the coupled bending-torsion stability analysis developed by considering the coupled equations of motion together with the unsteady aerodynamic loading. The effect of this aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter as well as the verification of the modeling are then demonstrated by considering an unstable 12 bladed rotor, with Verdon's uniformly spaced Cascade B flow geometry as a baseline. However, with the elastic axis and center of gravity at 60 percent of the chord, this type of aerodynamic detuning has a minimal effect on stability. For both uniform and nonuniform circumferentially space rotors, a single degree of freedom torsion mode analysis was shown to be appropriate for values of the bending-torsion natural frequency ratio lower than 0.6 and higher 1.2. When the elastic axis and center of gravity are not coincident, the effect of detuning on cascade stability was found to be very sensitive to the location of the center of gravity with respect to the elastic axis. In addition, it was determined that when the center of gravity was forward of an elastic axis located at midchord, a single degree of freedom torsion model did not accurately predict cascade stability. Author

N86-21514*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTEGRATION EFFECTS OF UNDERWING FORWARD- AND REARWARD-MOUNTED SEPARATE-FLOW, FLOW-THROUGH NACELLES ON A HIGH-WING TRANSPORT
Milton Lamb and William K. Abeyounis Apr. 1986 31 p refs
(NASA-TM-87627; L-16026; NAS 1.15:87627) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental investigation was conducted in the Langley 16-Foot Transonic Tunnel at free-stream Mach numbers from 0.70 to 0.82 and angles of attack from -2.5 to 4.0 degrees to determine the integration effects of pylon-mounted underwing forward and rearward separate-flow, flow-through nacelles on a high-wing transonic transport configuration. The results showed that the installed drag of the nacelle/pylon in the rearward location was slightly less than that of the nacelle/pylon in the forward location. This reduction was due to the reduction in calculated skin friction of the nacelle/pylon configuration. In all cases the combined value of form, wave, and interference drag was excessively high. However, the configuration with the nacelle/pylon in a rearward location produced an increase in lift over that of the basic wing-body configuration. Author

N86-21515*# National Aeronautics and Space Administration, Washington, D.C.
LOSSES IN CHANNELS WITH INCREASED INTERNAL TURBULENCE
A. Ye. Zaryankin and G. S. Soloveva Jan. 1986 11 p refs Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR, Energetika i Transport (USSR), no. 5, 1976 p 164-168 Original language document was announced in IAA as A77-14955 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77995; NAS 1.15:77995) Avail: NTIS HC A02/MF A01 CSCL 01A

An approximate method for determining the effect of the level of turbulence on the aerodynamic characteristics of convergent and diffuser channels is examined. A momentum equation for the boundary layer is in the method, introducing external flow turbulence on the basis of experimental values of the coefficient of friction and the form factor. It is found that at significant levels of external turbulence, losses must be considered not only in the boundary layer but also in the central region of the channel. Author

N86-21516*# National Aeronautics and Space Administration, Washington, D.C.
THREE-DIMENSIONAL BOUNDARY LAYER ANALYSIS PROGRAM BLAY AND ITS APPLICATION
Ken-ichi Matsuno and Tomiko Ishiguro Jan. 1986 24 p refs Transl. into ENGLISH from proceedings of the NAL Symposium

on Aircraft Computational Aerodynamics, 1983 p 207-218 Symposium held in Tokyo, Japan, 30 Jun. - 1 Jul. 1983 Original language document was announced as N85-26632 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77962; NAS 1.15:77962) Avail: NTIS HC A02/MF A01 CSCL 01A

The boundary layer calculation program (BLAY) is a program code which accurately analyzes the three-dimensional boundary layer of a wing with an undefined plane. In comparison with other preexisting programs, the BLAY is characterized by the following: (1) the time required for computation is shorter than any other; (2) the program is adaptable to a parallel processing computer; and (3) the program is associated with a secondary accuracy in the z-direction. As a boundary layer modification to transonic nonviscous flow analysis programs, it is used to adjust viscous and nonviscous interference problems repeatedly. Its efficiency is an important factor in cost reduction in aircraft designing.
Transl. by B.G.

N86-21517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALYSIS FOR THE SOUND FIELD PRODUCED BY RIGID WIDE CORD DUAL ROTATION PROPELLERS OF HIGH SOLIDARITY IN COMPRESSIBLE FLOW
Sridhar M. Ramachandra and Lawrence J. Bober [1986] 42 p refs Presented at the 24th Aerospace Sciences Meeting, Reno, Nev., 6-8 Jan. 1986; sponsored by AIAA
(NASA-TM-87178; E-2826; NAS 1.15:87178) Avail: NTIS HC A03/MF A01 CSCL 01A

An unsteady lifting service theory for the counter-rotating propeller is presented using the linearized governing equations for the acceleration potential and representing the blades by a surface distribution of pulsating acoustic dipoles distributed according to a modified Birnbaum series. The Birnbaum series coefficients are determined by satisfying the surface tangency boundary conditions on the front and rear propeller blades. Expressions for the combined acoustic resonance modes of the front prop, the rear prop and the combination are also given. Author

N86-21518*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A NEW METHOD FOR LAMINAR BOUNDARY LAYER TRANSITION VISUALIZATION IN FLIGHT: COLOR CHANGES IN LIQUID CRYSTAL COATINGS
Bruce J. Holmes, Peter D. Gall, Cynthia C. Croom, Gregory S. Manuel, and Warren C. Kelliher Jan. 1986 9 p refs Original contains color illustrations
(NASA-TM-87666; NAS 1.15:87666) Avail: NTIS HC A02/MF A01 CSCL 01A

The visualization of laminar to turbulent boundary layer transition plays an important role in flight and wind-tunnel aerodynamic testing of aircraft wing and body surfaces. Visualization can help provide a more complete understanding of both transition location as well as transition modes; without visualization, the transition process can be very difficult to understand. In the past, the most valuable transition visualization methods for flight applications included sublimating chemicals and oil flows. Each method has advantages and limitations. In particular, sublimating chemicals are impractical to use in subsonic applications much above 20,000 feet because of the greatly reduced rates of sublimation at lower temperatures (less than -4 degrees Farenheit). Both oil flow and sublimating chemicals have the disadvantage of providing only one good data point per flight. Thus, for many important flight conditions, transition visualization has not been readily available. This paper discusses a new method for visualizing transition in flight by the use of liquid crystals. The new method overcomes the limitations of past techniques, and provides transition visualization capability throughout almost the entire altitude and speed ranges of virtually all subsonic aircraft flight envelopes. The method also has wide applicability for supersonic transition visualization in flight and for general use in wind tunnel research over wide subsonic and supersonic speed ranges. Author

N86-21519*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFECT OF FLOW OSCILLATIONS ON CAVITY DRAG AND A TECHNIQUE FOR THEIR CONTROL
M. Gharib, A. Roshko, and V. Sarohia 30 Sep. 1985 70 p refs Prepared for Army Research Office, Research Triangle Park, N.C.
(Contract NAS7-100)
(NASA-CR-176652; JPL-PUB-85-72; NAS 1.26:176652) Avail: NTIS HC A04/MF A01 CSCL 01A

Experiments to relate the state of the shear layer to cavity drag have been performed in a water channel using a 4' axisymmetric cavity model. Detailed flow measurements in various cavity flow oscillation phases, amplitude amplification along the flow direction, distribution of shear stress, and other momentum flux obtained by laser Doppler velocimeter are presented. Measurements show exponential dependence of cavity drag on the length of the cavity. A jump in the cavity drag coefficient is observed as the cavity flow shows a bluff body wake type behavior. Natural and forced oscillations are introduced by a sinusoidally heated thin-film strip which excites the Tollmein-Schlichting waves in the boundary layer upstream of the gap. For a large gap, self-sustained periodic oscillations are observed, while for smaller gaps, which do not oscillate naturally, periodical oscillations can be obtained by external forcing through the strip heater. The drag of the cavity can be increased by one order of magnitude in the non-oscillating case through external forcing. Also, it is possible to completely eliminate mode switching by external forcing. For the first time, it is demonstrated that amplitude of cavity flow Kelvin-Helmholtz wave is dampened or cancelled by introduction of external perturbation of natural flow frequency but different phase. Author

N86-21520*# Kansas Univ., Lawrence.
THEORY OF WING ROCK
Chung-Hao Hsu and C. Edward Lan Feb. 1984 112 p refs
(Grant NAG1-134)
(NASA-CR-176640; NAS 1.26:176640; CRINC-FRL-516-1) Avail: NTIS HC A06/MF A01 CSCL 01A

A theory is developed for predicting wing rock characteristics. From available data, it can be concluded that wing rock is triggered by flow asymmetries, developed by negative or weakly positive roll damping, and sustained by nonlinear aerodynamic roll damping. A new nonlinear aerodynamic model that includes all essential aerodynamic nonlinearities is developed. The Beecham-Titchener method is applied to obtain approximate analytic solutions for the amplitude and frequency of the limit cycle based on the three degree-of-freedom equations of motion. An iterative scheme is developed to calculate the average aerodynamic derivatives and dynamic characteristics at limit cycle conditions. Good agreement between theoretical and experimental results is obtained. Author

N86-21521# Boston Univ., Mass. Center for Computational and Applied Dynamics.
TWO METHODS FOR VISCOUS AND INVISCID FREE-WAKE ANALYSIS OF HELICOPTER ROTORS Final Report, 15 Feb. 1983 - 14 Apr. 1985
L. Morino and B. Bharadvaj Aug. 1985 147 p
(Contract DAAG29-83-K-0050)
(AD-A161513; CCAD-TR-85-2; ARO-19797.3-EG) Avail: NTIS HC A07/MF A01 CSCL 20/4

Two integral equation methods for the free wake analysis of helicopter rotors (for potential and rotational flows, respectively) have been presented. The rotational flow formulation is based upon Helmholtz scalar/vector-potential decomposition. The advantages of the rotational flow formulation over the potential flow formulation have been discussed. The numerical equivalence of the two methods have been demonstrated. It should be noted that (whereas in the potential flow problem viscosity may be introduced only as artificial viscosity) in the rotational-flow formulation the presence of viscosity is consistent with the formulation. Therefore, this formulation is applicable to the solution of time-averaged Navier-Stokes equations: in particular, a simplified thin-wake analysis with an elementary eddy-viscosity model for turbulence is used in the numerical applications. Analysis of the

computer times indicates that the new formulation presented here (for rotational flows) has much broader applicability than the formulation for potential flows, while requiring approximately the same amount of computer time. GRA

N86-21522# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACTA MECHANICA SINICA (SELECTED ARTICLES)
Xieyuan Yin, Nan Xia, Guohua Deng, Dayou Liu, and Jilin Yu 5 Dec. 1985 125 p Transl. into ENGLISH from Lixue Xuebao (China), no. 5, 485-520 1984 p 454-475
(AD-A162726; FTD-ID(RS)T-0494-85) Avail: NTIS HC A06/MF A01 CSCL 20/4

The following articles appeared in Acta Mechanica Sinica, No. 5, 1984: Investigation of Rolling-up and Interaction of Leading-edge and Trailing-edge Vortex Sheets on a Slender Delta Wing; Calculation of Circular Jet with Particles Impacting Upon a Plate; A Non-local Elastic Plastic Continum Model and the Distress Distribution Near a Cracked Tip; Study of Plane Stress with Elastic Plastic Mixed Node Fracture; An Analytical Solution of Dynamic Response for Ideal Rigid Plastic; and General Variational Theorem for Structural Plastic Buckling Analysis Using Deformation Theory. GRA

N86-21523# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
MEASUREMENTS OF THE SYMMETRIC AERODYNAMIC COEFFICIENTS FOR FLAT FACED CYLINDERS WITH STRAKES IN THE ANGLE OF ATTACK REGIME 70 TO 90 DEG FOR TRANSONIC SPEED M.S. Thesis - Royal Inst. of Technol., Stockholm
Aake Roth Jul. 1985 179 p refs
(FFA-TN-1985-39) Avail: NTIS HC A09/MF A01

Flat faced cylinder bodies with strakes were examined in a wind tunnel for 6 Mach numbers in the range 0.6 to 1.0. The length to diameter ratios were 2, 4, 6, and 8. Each cylinder had 3 different pairs of strakes along the whole body forming the halfspan to radius ratios 1.20, 1.55, and 2.00. Angle of attack range was 70 to 90 deg. The coefficients normal force, pitching moment, tangential force (CN, CM, CT) increase as the halfspan to radius ratio increases. The same happens to CN and CM when the length to diameter ratio increases; CN is slightly affected by the angle of attack. Author (ESA)

N86-21524# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Hauptabteilung Windkanaele.
INVESTIGATION OF FERRI INSTABILITY IN SUPERSONIC INLETS
Ernst-Otto Krohn and Klaus Triesch Jun. 1985 34 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-978)
(DFVLR-FB-85-53; ISSN-0171-1342) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13

Ferri instability, caused by the inflow of a discontinuity surface (slipline) in the inlet was studied. A criterion for the appearance of the Ferri instability was derived. Flat inlets are the most, and semirotationsymmetric inlet the least, sensitive to Ferri instability. Means to avoid the instability are discussed. Strength and penetration depth of the slipline play a role in triggering the instability, although this role is not classified. Author (ESA)

N86-22258# Joint Publications Research Service, Arlington, Va.
NUMERICAL ANALYSIS OF NONEQUILIBRIUM FLOW ABOUT AIRFOIL IN THIN SHOCK LAYER APPROXIMATION Abstract Only
V. N. Golubkin and V. V. Negoda *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 5 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 25, no. 4, Apr. 1985 p 599-608 Original language document was announced in IAA as A85-33593 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-21525# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: AIR CANADA FLIGHT 797, MCDONNELL DOUGLAS DC-9-32, C-FTLU GREATER CINCINNATI INTERNATIONAL AIRPORT, COVINGTON, KENTUCKY, JUNE 2, 1983 Accident Report, 2 Jun. 1983
31 Jan. 1986 118 p refs
(PB86-910402; NTSB/AAR-86-02) Avail: NTIS HC A06/MF A01 CSCL 01C

A fire aboard a McDonnell Douglas DC-9-32, at the Greater Cincinnati International Airport, Covington, Kentucky, and the death of 23 passengers is reported. A fire in the aft lavatory was discovered while in flight and an emergency descent was made. Airport support, escape measures, and fire fighting are described. It was determined that the probable causes of the accident were: (1) a fire of undetermined origin; (2) an underestimate of fire severity; and (3) misleading fire progress information provided to the captain. It is concluded that the time taken to evaluate the nature of the fire and to decide to initiate an emergency descent contributed to the severity of the accident. E.A.K.

N86-21526# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: GALAXY AIRLINES, INC., LOCKHEED ELECTRA-L-188C, N5532, RENO, NEVADA, JANUARY 21, 1985
4 Feb. 1986 89 p
(PB86-910401; NTSB/AAR-86-01) Avail: NTIS HC A05/MF A01 CSCL 01C

About 0102:30 Pacific standard time on January 21, 1985, Galaxy Airlines Flight 203, a Lockheed Electra charter flight en route to Minneapolis, Minnesota, departed runway 16R of the Reno-Cannon International Airport. Approximately one minute later, the crew requested a turn to a left downwind to return to the airport because of a vibration in the airplane. In accordance with the request, the tower controller cleared the flight to make a left turn to a downwind traffic pattern. The airplane crashed at 0104 into an area 1 1/2 miles from the departure end of runway 16R, and 3/4 mile to the right of the extended runway centerline. The impact and subsequent fire killed the crew of six and 64 of the 65 passengers onboard. The airplane was destroyed. The sky was clear and the visibility was 12 miles at the time of the accident. The National Transportation Safety Board determines that the probable cause of this accident was the captain's failure to control and the copilot's failure to monitor the flight path and airspeed of the aircraft. This breakdown in crew coordination followed the onset of unexpected vibration shortly after takeoff. Contributing to the accident was the failure of ground handlers to properly close an air start access door, which led to the vibration. Author

N86-21527# Flight Safety Foundation, Inc., Arlington, Va.
PROCEEDINGS OF CABIN SAFETY CONFERENCE AND WORKSHOP HELD ON 11-14 DECEMBER 1984 Final Report
Aug. 1985 221 p Conference and Workshop held 11-14 Dec. 1984
(AD-A160950; DOT/FAA/ASF-100-85/01; DOT-TSC-FAA-85-6) Avail: NTIS HC A10/MF A01 CSCL 01/2

These proceedings contain formal conference presentations as well as summaries of informal workshop discussions on how to further improve aircraft cabin occupant safety. The overall objective of the conference is increased communication between various segments of the aviation community in the area of aircraft safety. Also included are the FSF's analysis and future recommendations for occupant safety. Topics covered include: overview of aircraft occupant safety problems; cabin safety initiatives; inflight

occupant protection; crash and fire protection; evacuation and survival; economics and regulatory considerations. GRA

N86-21528# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
AIRCRAFT MISHAP FIRE PATTERN INVESTIGATIONS Final Report, 1 Jun. 1984 - 31 Jul. 1985
Joseph M. Kuchta (Green International, Inc., Sewickley, Pa.) and Robert G. Clodfelter Aug. 1985 190 p
(Contract F33615-83-C-2359)
(AD-A161094; AFWAL-TR-85-2057) Avail: NTIS HC A09/MF A01 CSCL 01/2

This manual was prepared to provide the aircraft mishap investigator with state-of-the-art data and guidelines for investigating aircraft fires and explosions. Sections are included on investigating procedures, properties of air atmospheres, properties of aircraft combustibles (liquids, gases, or solids), properties of ordnance explosives, and damage analyses relating to fires and explosions. Procedures for accumulating, developing, and analyzing the evidence are outlined, and various combustion data are summarized for use in determining the ignition source, combustible source, and mishap scenario. To help establish the mishap scenario, damage criteria are given in terms of material or biological response to fire temperatures, explosion pressures, toxic gases, and other potentially hazardous exposures. Methods for calculating combustion quantities and damage potentials, including material failures, are included in this manual. Author (GRA)

N86-21529# Federal Aviation Administration, Atlantic City, N.J.
AIRCRAFT INTERIOR PANEL TEST CRITERIA DERIVED FROM FULL-SCALE FIRE TESTS Final Report
R. G. Hill, T. I. Eklund, and C. P. Sarkos Sep. 1985 65 p Original contains color illustrations
(AD-A161637; FAA/CT-85/23) Avail: NTIS HC A04/MF A01 CSCL 01/2

Full-scale cabin fire tests were conducted to determine potential increases in passenger survivability associated with different interior honeycomb panel constructions. The test fuselage was a C-133 with a simulated wide-body door opening exposed to an 8-foot by 10-foot fuel fire. In the first series, the interior near the door was lined with the honeycomb panels to determine whether earlier studies performed with small-scale enclosures were consistent with the full-scale counterpart. These earlier studies resulted in the selection of the Ohio State University (OSU) Rate of Heat Release Apparatus as the most appropriate type test to evaluate aircraft panels. The first series was followed by tests that included fire-blocked seats and carpeting as well as the panels to determine the type survivability increases that could be attained from low heat release materials. The scenario employed generally resulted with flashover within 2 minutes for panels considered typical in performance. A low heat release phenolic/fiberglass panel demonstrated a flashover delay until about 4 minutes into the test. An incombustible panel prevented flashover altogether. The performance of the various panels was evaluated to develop recommended flammability criteria for a modified OSU Rate of Heat Release Apparatus. GRA

N86-21530# Transportation Systems Center, Cambridge, Mass.
GENERAL AVIATION PILOT AND AIRCRAFT ACTIVITY SURVEY Final Report, 1984
Carolyn Frank and Jon Ohman Sep. 1985 83 p Prepared in cooperation with Automated Sciences Group, Inc., Silver Spring, Md.
(Contract DTRS-57-84-C-00100)
(AD-A161665; TSC-FAA-85-7; FAA-MS-85-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

A summary and analysis of the data collected in the 1984 General Aviation Pilot and Aircraft Activity Survey is provided. The survey was conducted at a random sample of general aviation airports across the nation throughout the months of July, August, September, and October, 1984 by the Federal Aviation Administration with the assistance of the Civil Air Patrol. The survey data provide information regarding the magnitude and characteristics of general aviation including: type and source of weather information services, trip length in time and distance, and pilot age and certification. Estimates are made of total 1984 general aviation operations, fuel consumption and aircraft miles flown. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-21531# European Space Agency, Paris (France).
ALGORITHMS FOR THE AUTOMATIC FOUR-DIMENSIONAL GUIDANCE OF AIRCRAFT, TAKING INTO ACCOUNT THE CURRENT WIND SITUATION
Werner Lechner Oct. 1985 108 p refs Transl. into ENGLISH of "Algorithmen zur automatischen 4 dimensionalen Flugbahnfuehrung unter Beruecksichtigung der momentanen Windsituation" Rept. DFVLR-FB-84-40 Brunswick, West Germany, Sep. 1984
(ESA-TT-908; DFVLR-FB-84-40) Avail: NTIS HC A06/MF A01

An automatic time-of-arrival control flight mode covering the terminal maneuvering area was developed for the digital flight-control system of the HFB 320 test aircraft and flight tested. The algorithms used for computing four dimensional flight paths taking into account the current wind situation are described. Methods for measuring, filtering, and predicting the wind vector are developed and discussed with reference to the results of the flight tests. Evaluation shows that time error limits of + or - 5 sec can be achieved under varied wind situations. The aircraft-oriented method of wind prediction by extrapolation, based on the Kalman filter method, proves to be particularly efficient. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-21532 Royal Aircraft Establishment, Farnborough (England).
STRUCTURAL MATERIALS IN AERONAUTICS: PROSPECTS AND PERSPECTIVES
G. G. Pope 28 Aug. 1985 45 p refs Presented at European Pioneers Day Meeting, Paris, 25 Apr. 1985
(RAE-TR-85077; BR97329) Copyright. Avail: NTIS HC A03/MF A01

Developments in materials and their prospects of application in airframes and engines are reviewed. Technical and cost considerations that govern material selection; and the merits of fiber composites, titanium alloys, steels and aluminum alloys for airframe applications are examined. The benefits offered by fiber composites must be assessed for specific applications in relation to developments in aluminum alloys, notably lithium-containing alloys and alloys produced by rapid solidification or condensation. Titanium alloys and steels are expected to fulfil an important but limited role in airframes. In the engine, titanium and nickel-base alloys respectively will satisfy most compressor and turbine requirements, although use of ceramics is expected. It is concluded that new materials are acceptable only if a clear understanding is achieved of the relationship between composition, microstructure and material behavior, the manufacturing route, and quality control of the product. Author (ESA)

N86-21533# Cranfield Inst. of Tech., Bedford (England). Coll. of Aeronautics.

A PROGRAMME OF RESEARCH INTO THE AERODYNAMICS, STABILITY AND CONTROL CHARACTERISTICS OF A COMBAT AIRCRAFT HAVING A FORWARD SWEPT WING Interim Report, Nov. 1984 - Oct. 1985

M. V. Cook and F. Heydari Oct. 1985 16 p refs
(CAR-8516; ISBN-0-947767-27-4)
Avail: NTIS HC A02/MF A01

The aerodynamic stability and control characteristics of the forward swept wing aircraft, and likely stability augmentation requirements were studied. It is found that: (1) the theoretical aerodynamic models match the observed aerodynamic performance; (2) the estimated stability derivatives when incorporated in a computer simulation provide response characteristics which agree with experimentally derived responses; (3) the parametric identification technique is effective; (4) theoretical predictions of longitudinal static stability margins indicate that the aircraft is more stable than observed in experiments; (5) feedback control is relatively straightforward; and (6) the experimental system permits dynamic testing on the aircraft model with a longitudinal static stability margin as small as -4%. E.A.K.

N86-21534*# National Aeronautics and Space Administration, Washington, D.C.

PROCEDURE FOR UTILIZING THE LIFT AND THRUST FORCES OF ORNITHOPTERS

C. Bezard Nov. 1985 15 p Transl. into ENGLISH of French Patent no. 8404354 (21 Mar. 1984) p 1-15 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77682; NAS 1.15:77682) Avail: NTIS HC A02/MF A01 CSCL 01C

This procedure is distinguished by two beating wings which together describe, in space, a succession of interlaced triangles. On these wings, whose incidence varies automatically, identical forces are exerted: simultaneous lift and thrust when they make their descent, which is inclined toward the front of the craft, and lift alone when they make their ascent, which is inclined toward the rear of the craft and follows a slide horizontal movement. A mechanical device makes these movements possible. It includes: two wings with hollow profiles, connected by a framework located above a rigid frame and attached to it by bars with joints. These bars are moved with control rods which gear down the drive force. A mechanism with elastic bands or springs automatically varies the incidence of the wings. Author

N86-21535*# National Aeronautics and Space Administration, Washington, D.C.

VERTICALLY OPERATING FLIGHT VEHICLE FOR DRILLING AND AGRICULTURAL USE

W. Pabst Mar. 1986 13 p Transl. into ENGLISH of West German Patent no. P3521624.7 (10 Jun. 1985) p 1-12 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77713; NAS 1.15:77713) Avail: NTIS HC A02/MF A01 CSCL 01C

The invention deals with an aircraft which ascends and descends vertically and which is used for recreational aircraft, as well as for drilling and in agriculture. The invention combines the floating effect of a parachute with the helicopter to develop a flight vehicle with multiple uses which go beyond those of contemporary flight vehicles. Both hub mechanisms and thrust power are implemented to achieve this goal. Four designs are described in detail. Author

N86-21536# Boeing Co., Seattle, Wash.

OPERATION REDWING, PROJECT 5.2, IN-FLIGHT PARTICIPATION OF A B-52

F. L. Williams 1 Apr. 1985 69 p refs Prepared in cooperation with Aeronautical Systems Div., Wright-Patterson Air Force Base, Ohio Prepared for DNA, Washington, D.C.
(AD-A995286; WT-1328-Ex) Avail: NTIS HC A04/MF A01 CSCL 18/3

Measured energy input and aircraft response data on an instrumented B-52 aircraft when subjected to the thermal, blast, and gust effects of a nuclear explosion were examned. The spatial location for the B-52, relative to a detonation, that would result in the desired aircraft inputs and responses was analyzed. The B-52 participated in nine shots. The reliability of the instrumentation system was between 95% and 100% throughout the test program. It is recommended that the B-52 not participate in future nuclear tests as a weapons-capability aircraft. E.A.K.

N86-21537# Aeronautical Research Labs., Melbourne (Australia).

COMPARISON OF AIRBORNE DATA ACQUISITION SYSTEMS AT ARL (AERONAUTICAL RESEARCH LABORATORIES)

G. F. Forsyth Sep. 1985 13 p
(AD-A161664; ARL/AERO-PROP-TM-430) Avail: NTIS HC A02/MF A01 CSCL 09/2

During formulation of plans to raise contracts to implement a new data acquisition arrangement to suit aircraft engines and other propulsion components, it became necessary to evaluate other systems which might be available for the same or similar tasks. Accordingly details have been collected on all the various airborne data acquisition systems which may be considered for use at ARL. Later sections of this paper compare the major capabilities of the various airborne data acquisition systems currently available at ARL and of some systems which have recently become available from industry. GRA

N86-21538# Air Univ., Maxwell AFB, Ala.

THE EVOLUTION OF THE CRUISE MISSILE

Kenneth P. Werrell Sep. 1985 300 p
(AD-A162646) Avail: NTIS HC A13/MF A01; also available SOD $7.00 CSCL 16/4

While weapons come and go in the military, history provides examples of classes of weapons having both a dramatic and a lasting impact upon the conduct of warfare. These examples involve weapons which were, at their inception, revolutionary since they were not merely new but clearly superior to equipment already in use on the battlefield. Because they dominated warfare they were crucial to battlefield success; and nations possessing and using such weapons effectively were, more often than not, victorious. A class of missile of particular interest, now entering the US inventory, is the cruise missile. The purpose of this study is to evaluate the cruise missile against the criteria suggested above, seeking answers to two basic questions: is the current cruise missile simply another weapon in the now familiar class of aerial munitions? or does it represent a potentially revolutionary class of weapons in its own right? These questions, and the answers to them, may well have far-reaching implications, for if the current version of the cruise missile represents not an evolutionary development but a quantum leap forward in weaponry, then US development and employment strategies require significant adjustment. GRA

N86-21539# Naval Postgraduate School, Monterey, Calif.

HELICOPTER PERFORMANCE COMPUTER PROGRAMS FOR HP-41 HAND-HELD COMPUTER

Donald M. Layton Dec. 1985 73 p
(AD-A162794) Avail: NTIS HC A04/MF A01 CSCL 01/3

This document has reference tables and programs used to evaluate helicopter performance in the areas of: Autorotation; Service and Combat Ceilings; Basic Power Required Parameters; Fuel Consumption; High Speed Effects; Basic Power Considerations; Maximum Endurance Power/Velocity; Maximum Rage Power/Velocity; and Weight Estimation Relationships. These programs present the user of the HP-41 hand-held, programmable calculator with a series of self-prompting, alphanumeric programs that can be used with acceptable results to compute and evaluate helicopter performance. Most of the programs are structured so as to be more expedient when doing preliminary helicopter design where intermediate values are of less a concern than would be the case when studying detailed performance. GRA

N86-21540# Department of the Air Force, Washington, D.C.

ROBOTIC REFUELING SYSTEM FOR TACTICAL AND STRATEGIC AIRCRAFT Patent Application

Edwin R. Schultz, inventor (to Air Force) Filed 12 Aug. 1985 17 p
(AD-D011980; US-Patent-Appl-SN-764820) Avail: NTIS HC A02/MF A01 CSCL 01/2

A ground based aircraft refueling system uses existing air-to-air refueling technology. A fixed facility design attaches a moveable air-to-air type refueling boom and probe to an overhead track mounted on the ceiling of a TAB VEE aircraft shelter. Movement of the boom and probe is controlled from a remote control room protected from hazardous chemical and biological environments. In a second embodiment a moveable facility design mounts on the top of a tank truck a first boom attached at a right angle to an air-to-air type refueling second boom and probe. The booms and probe are remotely controlled from the truck cab which is protected from hostile chemical and biological environments. A third embodiment adds to the moveable facility design a second tank and nozzle outlet for spraying decontaminate. Author (GRA)

N86-21541# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Forschungsbereich Nachrichtentechnik und Erkundung.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF FLOW VECTOR MEASUREMENTS WITH ANGLE-OF-ATTACK AND SIDESLIP SENSORS ON DFVLR METEOROLOGICAL RESEARCH AIRCRAFT Ph.D. Thesis - Technische Univ., Munich, West Germany
Peter Muehlbauer Jun. 1985 132 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-976)
(DFVLR-FB-85-50; ISSN-0171-1342) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 42.50

Calibration of the equipment of three powered sail planes and a jet plane with angle-of-attack and sideslip sensors for measuring the local flow vector is described. The impact of angle-of-attack and sideslip and of other interfering parameters on the measured value was studied. A mathematical simulation of compressible flow at the tip of the probe is followed by experimental wind tunnel investigations, analysis, and application on in-flight measurement. Criteria for flight-test use of the sensors are outlined.Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N86-21542# Radio Technical Commission for Aeronautics, Washington, D. C.
MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AIRBORNE DISTANCE MEASURING EQUIPMENT (DME) OPERATION WITHIN THE RADIO FREQUENCY RANGE OF 960-1215 MEGAHERTZ
20 Sep. 1985 195 p refs
(RTCA/DO-189; SC-149) Avail: NTIS HC A09/MF A01

Minimal operational performance standards for airborne distance measuring equipment (DME) operating within the radio frequency range of 960 to 1215 MHz are contained. Information needed to understand the rationale for equipment characteristics and requirements is stated along with the minimum performance standards for the equipment. These standards define required performance under standard operating conditions and stressed physical environmental conditions. The operational performance characteristics are described for equipment installations and conditions and tests that will assure the user that the equipment will perform safely and reliably in the expected operational environment are defined. A configuration of airborne equipment encompassing an antenna system, transmission lines, DME interrogator, interrogator control unit and interfaces with aircraft displays/systems are considered. B.G.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-21543*# National Aeronautics and Space Administration, Washington, D.C.
HIGH FREQUENCY-HEATED AIR TURBOJET
Juan Heliodoro Diaz Miron Feb. 1986 12 p Transl. into ENGLISH of Spanish Patent no. 293,727 (21 Nov. 1983) p 1-10 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77710; NAS 1.15:77710) Avail: NTIS HC A02/MF A01 CSCL 21E

A description is given of a method to heat air coming from a turbojet compressor to a temperature necessary to produce required expansion without requiring fuel. This is done by high frequency heating, which heats the walls corresponding to the combustion chamber in existing jets, by mounting high frequency coils in them. The current transformer and high frequency generator to be used are discussed. Author

N86-21544*# National Aeronautics and Space Administration, Washington, D.C.
CORROSION AND CORROSION PREVENTION IN GAS TURBINES
A. J. A. Mom and H. J. Kolkman Nov. 1985 43 p refs Transl. into ENGLISH of "Corrosie en Corrosiebestrijding in Gasturbines" rept. NLR-MP-82048-U National Aerospace Lab., Amsterdam, Netherlands, 30 Sep. 1981 p 1-42 Original language document was announced as N84-19355 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77924; NAS 1.15:77924; NLR-MP-82048-U) Avail: NTIS HC A03/MF A01 CSCL 21E

The conditions governing the corrosion behavior in gas turbines are surveyed. Factors such as temperature, relative humidity, the presence of sulfur and nitrogen dioxide, and fuel quality are discussed. Electromechanical corrosion at relatively low temperature in compressors; oxidation; and hot corrosion (sulfidation) at high temperature in turbines are considered. Corrosion prevention by washing and rinsing, fueld additives, and corrosion resistant materials and coatings are reviewed. Author (ESA)

N86-21545*# Purdue Univ., West Lafayette, Ind. School of Mechanical Engineering.
SPONTANEOUS IGNITION DELAY CHARACTERISTICS OF HYDROCARBON FUEL-AIR MIXTURES Final Report
Arthur H. Lefebvre, William G. Freeman, and Luke H. Cowell Feb. 1986 102 p refs
(Grant NAG3-226)
(NASA-CR-175064; NAS 1.26:175064) Avail: NTIS HC A06/MF A01 CSCL 21E

The influence of pressure on the autoignition characteristics of homogeneous mixtures of hydrocarbon fuels in air is examined. Autoignition delay times are measured for propane, ethylene, methane, and acetylene in a continuous flow apparatus featuring a multi-point fuel injector. Results are presented for mixture temperatures from 670K to 1020K, pressures from 1 to 10 atmospheres, equivalence ratios from 0.2 to 0.7, and velocities from 5 to 30 m/s. Delay time is related to pressure, temperature, and fuel concentration by global reaction theory. The results show variations in global activation energy from 25 to 38 kcal/kg-mol, pressure exponents from 0.66 to 1.21, and fuel concentration exponents from 0.19 to 0.75 for the fuels studied. These results are generally in good agreement with previous studies carried out under similar conditions. Author

N86-21546*# General Motors Corp., Indianapolis, Ind. Gas Turbines Div.
TURBINE VANE EXTERNAL HEAT TRANSFER. VOLUME 1: ANALYTICAL AND EXPERIMENTAL EVALUATION OF SURFACE HEAT TRANSFER DISTRIBUTIONS WITH LEADING EDGE SHOWERHEAD FILM COOLING
E. R. Turner, M. D. Wilson, L. D. Hylton, and R. M. Kaufman Jul. 1985 246 p refs
(Contract NAS3-23695)
(NASA-CR-174827; NAS 1.26:174827; EDR-11984-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 21E

Progress in predictive design capabilities for external heat transfer to turbine vanes was summarized. A two dimensional linear cascade (previously used to obtain vane surface heat transfer distributions on nonfilm cooled airfoils) was used to examine the effect of leading edge shower head film cooling on downstream heat transfer. The data were used to develop and evaluate analytical models. Modifications to the two dimensional boundary layer model are described. The results were used to formulate and test an effective viscosity model capable of predicting heat transfer phenomena downstream of the leading edge film cooling array on both the suction and pressure surfaces, with and without mass injection. B.G.

N86-21547# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
JET ENGINE OPERATING AND SUPPORT COST ESTIMATING RELATIONSHIP DEVELOPMENT M.S. Thesis
Brenda H. Cox Sep. 1985 106 p
(AD-A161683; AFIT/GSM/LSY/85S-8) Avail: NTIS HC A06/MF A01 CSCL 14/1

This investigation derived a jet engine Cost Estimating Relationship (CER) model from multivariate linear regression techniques. Prior to the model's development, all known jet engine cost data bases were examined for applicability to the thesis effort. After identifying constraints and limitations in the data, stepwise regression equations for analysis. The best equation was identified base on pre-established logic and statistical criteria. The equation selected had the following performance, physical, and usage variables: Turbine Inlet Temperature, Specific Fuel Consumption, Weight, and Annual Engine Flying Hours. Results of the model development can be used in comparative cost analyses of present and proposed weapon systems; in cost trade-off studies to determine impact of design alternatives for new engineers; in reports to Congress on the costs of operating engines; and in estimating budget requirements. GRA

N86-21548# Department of the Air Force, Washington, D.C.
DUAL MATERIAL EXHAUST NOZZLE FLAP Patent Application
Dudley O. Nash, inventor (to Air Force) Filed 1 Oct. 1985 19 p
(AD-D011998; US-Patent-Appl-SN-782332) Avail: NTIS HC A02/MF A01 CSCL 21/5

This patent application discloses an exhaust nozzle flap capable of resisting high exhaust temperatures of turbojet engines. The flap is composed of a two-part structure of high strength metal, in a support member, combined with a heat resistant base member made from a ceramic or carbon-carbon material. The different materials in the base and support members, having substantially different rates of thermal expansion, are not bolted or riveted together, but attached in a unique manner to allow relative movement therebetween. GRA

N86-21888# General Motors Corp., Indianapolis, Ind. Gas Turbine Operations.
DAMPING APPLICATIONS IN TURBINE ENGINES
R. L. Jay and D. W. Burns *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 23 p ref (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21890# Stress Technology, Inc., Rochester, N.Y.
DAMPING PROPERTIES OF STEAM TURBINE BLADES
Neville F. Rieger *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 31 p refs Sponsored in part by the Electric Power Research Inst. (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21892# Carnegie-Mellon Univ., Pittsburgh, Pa.
RESEARCH ON FRICTION DAMPING IN JET ENGINES AT CARNEGIE-MELLON UNIVERSITY
J. H. Griffin and J. Bielak *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 12 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC 99/MF A01 CSCL 20/11

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-21549*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STEP AND STEPSPL: COMPUTER PROGRAMS FOR AERODYNAMIC MODEL STRUCTURE DETERMINATION AND PARAMETER ESTIMATION
James G. Batterson Jan. 1986 142 p refs
(NASA-TM-86410; NAS 1.15:86410) Avail: NTIS HC A07/MF A01 CSCL 01C

The successful parametric modeling of the aerodynamics for an airplane operating at high angles of attack or sideslip is performed in two phases. First the aerodynamic model structure must be determined and second the associated aerodynamic parameters (stability and control derivatives) must be estimated for that model. The purpose of this paper is to document two versions of a stepwise regression computer program which were developed for the determination of airplane aerodynamic model structure and to provide two examples of their use on computer generated data. References are provided for the application of the programs to real flight data. The two computer programs that are the subject of this report, STEP and STEPSPL, are written in FORTRAN IV (ANSI I966) compatible with a CDC FTN4 compiler. Both programs are adaptations of a standard forward stepwise regression algorithm. The purpose of the adaptation is to facilitate the selection of a adequate mathematical model of the aerodynamic force and moment coefficients of an airplane from flight test data. The major difference between STEP and STEPSPL is in the basis for the model. The basis for the model in STEP is the standard polynomial Taylor's series expansion of the aerodynamic function about some steady-state trim condition. Program STEPSPL utilizes a set of spline basis functions. Author

N86-21550*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF WING MODIFICATION ON AN AIRCRAFT'S AERODYNAMIC PARAMETERS AS DETERMINED FROM FLIGHT DATA
Robert Alan Hess Jan. 1986 72 p refs
(NASA-TM-87591; NAS 1.15:87591) Avail: NTIS HC A04/MF A01 CSCL 01C

A study of the effects of four wing-leading-edge modifications on a general aviation aircraft's stability and control parameters is presented. Flight data from the basic aircraft configuration and configurations with wing modifications are analyzed to determine each wing geometry's stability and control parameters. The parameter estimates and aerodynamic model forms are obtained using the stepwise regression and maximum likelihood techniques. The resulting parameter estimates and aerodynamic models are verified using vortex-lattice theory and by analysis of each model's ability to predict aircraft behavior. Comparisons of the stability and control derivative estimates from the basic wing and the four leading-edge modifications are accomplished so that the effects

of each modification on aircraft stability and control derivatives can be determined. Author

N86-21551# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
LIMITING PERFORMANCE OF NONLINEAR SYSTEMS WITH APPLICATIONS TO HELICOPTER VIBRATION CONTROL Final Report, 1 Aug. 1982 - 31 Oct. 1984
W. D. Pilkey Aug. 1985 9 p
(Contract DAAG29-82-K-0164)
(AD-A161457; ARO-18643.10-EG) Avail: NTIS HC A02/MF A01 CSCL 20/11

Several problems concerning the vibration control of helicopters were studied. A method for introducing structural modifications leading to vibration reduction has been developed. In particular, a formulation for attaching appendages to continuous structural members was completed and applied to a two-beam helicopter model. Author (GRA)

N86-21552# Texas Technological Univ., Lubbock. Dept. of Mechanical Engineering.
STOCHASTIC NON-LINEAR FLUTTER OF AEROELASTIC STRUCTURES Annual Report, 1 Nov. 1984 - 31 Oct. 1985
Raouf A. Ibrahim 21 Oct. 1985 104 p
(Grant AF-AFOSR-0008-85)
(AD-A162748; AFOSR-85-1076TR; AR-1) Avail: NTIS HC A06/MF A01 CSCL 01/1

The linear and non-linear random modal interactions of a two degree-of-freedom aeroelastic structure are examined by using the Fokker-Planck equation approach. A general differential equation describing the evolution of the response moments is derived for any moment order. For the case of linear modal interaction this differential equation is found to constitute a closed set of moment equations. The stationary response is determined for various system parameters. It is found that the linear interaction results in a suppression of one mode when the uncoupled frequencies of the structure are close to each other. For the case of nonlinear modal (known as autoparametric) interaction the differential equation of the response moments forms an infinite coupled set of equations which are closed via two closure schemes. These are the Gaussian and non-Gaussian closure leads to 69 differential equations in the first four orders of response moments. The two sets are solved by numerical integration. GRA

N86-21553# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Forschungsbereich Flugmechanik/Flugfuehrung.
A CONTRIBUTION TO THE DIGITAL COMPENSATION OF PERIODIC DISTURBANCES WITH FREQUENCIES IN BOUNDED INTERVALS Ph.D. Thesis - Technische Univ., Berlin, West Germany
Rainer Froriep Sep. 1985 141 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-979)
(DFVLR-FB-85-55; ISSN-0171-1342) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 45.50

A general design method for the simplest possible compensator was developed in order to satisfy the requirement of stationary disturbance compensation within given tolerance limits for all helicopter rotor speeds within a given bounded interval. The approach to the suppression of rotor induced vibrations is to suspend the fuselage from the rotor by electrohydraulic actuators. Using a digital computer the most dominant harmonics of the disturbance can be actively compensated. For compensation at sampling instants, a structure of a digital controller is introduced and motivated, in which a minimal number of parameters is adapted to a varying rotor speed. The remaining parameters are to be held constant during operation independent of rotor speed. In the design, these parameters are systematically improved with a multidisturbance model approach and a design methodology with vector performance index. For disturbance suppression between sampling instants a design method for impulse forming filters is proposed. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-21554*# Essex Corp., Huntsville, Ala. Space Systems Group.
EMERGENCY MANAGEMENT COMPUTER-AIDED TRAINER (EMCAT) Final Report
Ricardo C. Rodriguez and Randall P. Johnson 31 Jan. 1986 26 p
(Contract NAS8-35815)
(NASA-CR-178738; NAS 1.26:178738; H-85-11) Avail: NTIS HC A03/MF A01 CSCL 14B

The Emergency Management Computer-Aided Trainer (EMCAT) developed by Essex Corporation or NASA and the Federal Emergency Management Administration's (FEMA) National Fire Academy (NFA) is described. It is a computer based training system for fire fighting personnel. A prototype EMCAT system was developed by NASA first using video tape images and then video disk images when the technology became available. The EMCAT system is meant to fill the training needs of the fire fighting community with affordable state-of-the-art technologies. An automated real time simulation of the fire situation was needed to replace the outdated manual training methods currently being used. In order to be successful, this simulator had to provide realism, be user friendly, be affordable, and support multiple scenarios. The EMCAT system meets these requirements and therefore represents an innovative training tool, not only for the fire fighting community, but also for the needs of other disciplines. Author

N86-21555# New Mexico Univ., Albuquerque.
RUBBER REMOVAL SPECIFICATION DEVELOPMENT Final Report, May 1983 - Sep. 1985
Richard A. Graul, Lary R. Lenke, and Daniel L. Standiford Oct. 1985 56 p refs Prepared in cooperation with Air Force Engineering Services Center, Tyndall AFB, Fla.
(Contract F29601-84-C-0080)
(FAA/PM-85/33; ESL-TR-85-67) Avail: NTIS HC A04/MF A01

The phenomenon of runway touchdown-zone rubber buildup is a potentially hazardous problem. Rubber buildup covers the runway surface and occludes the surface texture. This results in a reduced wet friction coefficient between the runway pavement and aircraft tires. Methods and equipment are available for evaluating the wet friction coefficient; however, these methods are expensive and require highly trained personnel. Currently, no guidelines have been established for determining the need and effectiveness of rubber removal. Therefore, most airport and airbase managers rely exclusively on visual impressions of rubber buildup in lieu of quantitative measurements. Quantitative evaluation techniques are desirable for evaluating rubber buildup. An extensive literature review suggested that pavement surface texture measurement techniques are indicative of rubber buildup and resultant reduction in wet friction coefficients. A statistically designed field experiment determined that surface texture measurements were indicative of pavement friction levels; however, these relationships lacked the precision necessary for inclusion in performance specifications. Author

N86-21556# New Mexico Univ., Albuquerque. Engineering Research Inst.
RUNWAY RUBBER REMOVAL SPECIFICATION DEVELOPMENT Final Report, May 1983 - Sep. 1985
Richard A. Graul, Lary R. Lenke, and Daniel L. Standiford Oct. 1985 56 p refs Prepared in cooperation with Air Force Engineering and Services Center, Tyndall AFB, Fla.
(Contract F29601-84-C-0080)
(DOT/FAA/PN-85/33; ESL-TR-85-67) Avail: NTIS

HC A04/MF A01

The phenomena of runway touchdown-zone rubber buildup is a potentially hazardous problem. Rubber buildup covers the runway surface and occludes the surface texture. This results in a reduced wet friction coefficient between the runway pavement and aircraft tires. Methods and equipment are available for evaluating the wet friction coefficient; however, these methods are expensive and require highly trained personnel. Currently, no guidelines have been established for determining the need and effectiveness of rubber removal. Therefore, most airport and airbase managers rely exclusively on visual impressions of rubber buildup in lieu of quantitative measurements. Quantitative evaluation techniques are desirable for evaluating rubber buildup. An extensive literature review suggested that pavement surface texture measurement techniques are indicative of rubber buildup and resultant reduction in wet friction coefficients. A statistically designed field experiment determined that surface texture measurements were indicative of pavement friction levels; however, these relationships lacked the precision necessary for inclusion in performance specifications. A summary of previous work in developing a rubber removal specification, supporting evidence for the frictional performance criteria proposed in developing a coherent specification for rubber removal contracts, and proposed contract specification criteria for runway rubber removal are given. Author

N86-21557*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

THERMAL SENSING OF CRYOGENIC WIND TUNNEL MODEL SURFACES Final Report, 15 May 1984 - 28 Feb. 1985

Kamran Daryabeigi and Robert L. Ash Oct. 1985 55 p refs (Contract NAS1-17099)

(NASA-CR-176641; NAS 1.26:176641) Avail: NTIS HC A04/MF A01 CSCL 14B

Different sensors and installation techniques for surface temperature measurement of cryogenic wind tunnel models were investigated. Silicon diodes were selected for further consideration because of their good inherent accuracy (their average absolute temperature deviation in comparison tests with standard platinum resistance thermometers was found to be 0.2 K in the range from 125 to 273 K). Subsurface temperature measurement was selected as the installation technique in order to minimize aerodynamic interference. Temperature distortion caused by an embedded silicon diode was studied numerically. Author

N86-21558# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Hauptabteilung Windkanaele.

FLOW FIELD MEASUREMENTS IN THE 3mx3m LOW SPEED WIND TUNNEL OF THE DFVLR IN GOETTINGEN (WEST GERMANY)

Arnulf Kuehn Jul. 1985 66 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-981)

(DFVLR-Mitt-85-14; ISSN-0176-7739) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 25

A ten-hole probe was developed for flow field measurements in a low speed wind tunnel. The probe allows the determination of the total and static pressures as well as the local direction in a flow field. Mechanical design, calibration procedure, and control system are described. The probe is moved in the wind tunnel by a three-dimensional displacement mechanism. The data acquisition and reduction system, and the presentation of results are described. The accuracy of the flow direction measurements is discussed. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-21559*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

GRAPHICAL TECHNIQUES TO ASSIST IN POINTING AND CONTROL STUDIES OF ORBITING SPACECRAFT

Leonard W. Howell and Joseph H. Ruf Mar. 1986 20 p (NASA-TP-2575; NAS 1.60:2575) Avail: NTIS HC A02/MF A01 CSCL 22A

Computer generated graphics are developed to assist in the modeling and assessment of pointing and control systems of orbiting spacecraft. Three-dimensional diagrams are constructed of the Earth and of geometrical models which resemble the spacecraft of interest. Orbital positioning of the spacecraft model relative to the Earth and the orbital ground track are then displayed. A star data base is also available which may be used for telescope pointing and star tracker field-of-views to visually assist in spacecraft pointing and control studies. A geometrical model of the Hubble Space Telescope (HST) is constructed and placed in Earth orbit to demonstrate the use of these programs. Simulated star patterns are then displayed corresponding to the primary mirror's FOV and the telescope's star trackers for various telescope orientations with respect to the celestial sphere. Author

N86-21560*# National Aeronautics and Space Administration, Washington, D.C.

DISTRIBUTED AUTOMATIC CONTROL OF TECHNOLOGICAL PROCESSES IN CONDITIONS OF WEIGHTLESSNESS

A. I. Kukhtenko, V. I. Merkulov, Yu. I. Samoylenko, and Yu. P. Ladikov-Royev Feb. 1986 18 p refs Transl. into ENGLISH from Kosmicheskie Issledovaniia na Ukraine (USSR), no. 6, 1975 p 7-15 Original language document was announced in IAA as A76-33508 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-4004)

(NASA-TM-77953; NAS 1.15:77953) Avail: NTIS HC A02/MF A01 CSCL 22A

Some problems associated with the automatic control of liquid metal and plasma systems under conditions of weightlessness are examined, with particular reference to the problem of stability of liquid equilibrium configurations. The theoretical fundamentals of automatic control of processes in electrically conducting continuous media are outlined, and means of using electromagnetic fields for simulating technological processes in a space environment are discussed. Author

N86-21561*# National Aeronautics and Space Administration, Washington, D.C.

MANNED SPACEFLIGHT IN THE NINETIES: THE EUROPEAN PERSPECTIVE

W. Finke Jan. 1985 11 p Transl. into ENGLISH of "Die Bemannte Raumfahrt in den Neunziger Jahren: Eine Europaeische Perspektive" presented at the International Symposium Towards Columbus and Space Station, 1985 p 1-9 Symposium held in Bad Godesberg, West Germany, 2 Oct. 1985 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-4005)

(NASA-TM-77697; NAS 1.15:77697) Avail: NTIS HC A02/MF A01 CSCL 22A

The inaugural speech for the international space travel symposium which took place in Bad Godesberg, West Germany on 2 Oct. 1985 explains why Europe must take an active part in all aspects of manned space travel for the nineties, including the development of the space station itself and the development of its own reusable space transport and supporting ground equipment to proceed on an equal share basis with the US and Japan while maintaining close international cooperation. Author

N86-21562*# National Aeronautics and Space Administration, Washington, D.C.

NORWEGIAN AEROSPACE ACTIVITIES: AN OVERVIEW

T. Arnesen, ed. and G. Rosenberg, ed. Feb. 1986 95 p ref Transl. into ENGLISH from Norsk Romvirksomhet IN: Norges Offentlige Utredninger (Oslo, Norway), no. 1, Jan. 1986 p 1-6,

30-31, 33-61, 66-71 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Government Committee of July 26, 1985
(Contract NASw-4005)
(NASA-TM-77711; NAS 1.15:77711; ISSN-0333-2306) Avail: NTIS HC A05/MF A01 CSCL 22A

Excerpts from a Governmental Investigation concerning Norwegian participation in the European Space Organization (ESA) is presented. The implications and advantages of such a move and a suggestion for the reorganization of Norwegian Aerospace activity is given. Author

N86-21563*# National Aeronautics and Space Administration, Washington, D.C.
CONTEMPORARY ACHIEVEMENTS IN ASTRONAUTICS: SALYUT-7, THE VEGA PROJECT AND SPACELAB
V. N. Kubasov, V. M. Balebanov, and D. Yu. Goldovskiy Mar. 1986 55 p Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhnike, Seriya: Kosmonavtika, Astronomiya (Moscow, USSR), no. 12, 1985 p 1-64 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77712; NAS 1.15:77712) Avail: NTIS HC A04/MF A01 CSCL 22A

The latest achievements in Soviet aeronautics are described; the new stage in the space program to study Venus using Soviet automated space probes, and the next space mission by cosmonauts to the Salyut-7 station. Information is also presented on the flight of the Spacelab orbiting laboratory created by Western European specialists. Author

N86-21564*# Alabama Univ., Huntsville. Environmental and Energy Center.
DROP TUBE TECHNICAL TASKS Final Report
Gary L. Workman Jan. 1986 44 p refs
(Contract NAS8-35665)
(NASA-CR-178741; NAS 1.26:178741; UAH-RR-475) Avail: NTIS HC A03/MF A01 CSCL 14B

Criteria, using fundamental thermochemical dynamics, were developed to assist a scientist using the Drop Tube Facility in designing a good experiment. The types of parameters involved in designing the experiments include the type of furnace, the type of atmosphere, and in general which materials are better behaved than others as determined by past experience in the facility. One of the major advantages of the facility lies in its ability to provide large undercoolings in the cooling curve during the drops. A beginning was to consider the effect of oxygen and other gases upon the amount of undercooling observed. The starting point of the thermochemistry was given by Ellingham and later transformed into what is known as the Richardson Chart. The effect of surface oxidations upon the nucleation phenomena can be observed in each specimen. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-21565# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
CONTROL OF MISSILE DISPERSION VIA ROLL RATE MODULATION
Daniel H. Platus and Jennifer Shandling 15 Nov. 1985 53 p Previously announced in IAA as A85-43839
(Contract F04701-85-C-0086)
(AD-A162542; TR-0086(6550)-1; SD-TR-85-77) Avail: NTIS HC A04/MF A01 CSCL 20/4

Feedback control via roll rate modulation to limit cross-range dispersion of spinning missiles is investigated. The dispersion to be controlled is assumed to result from lift variations that do not average out over a roll cycle when the missile roll rate remains constant. By modulating the roll rate in a prescribed manner through feedback control, lift nonaveraging and the resulting cross-range dispersion are minimized. Two different approaches to the feedback control are investigated. In one approach, the roll rate is modulated by feedback of the state variables to prevent the occurrence of lateral velocity increments that produce dispersion. In the other approach, the roll rate is modulated harmonically about a steady roll rate, and the amplitude of the harmonic variation is controlled to limit dispersion. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N86-21566# Ball Aerospace Systems Div., Boulder, Colo.
RADIATION-HARD BREADBOARD STAR TRACKER Final Report
M. W. Hubbard and D. L. Murata Sep. 1985 140 p
(Contract N00014-82-C-2488)

(AD-A162777; BASD/F85-03) Avail: NTIS HC A07/MF A01 CSCL 17/3

Operation in a radiation environment affects the performance of many types of electro-optical sensors. Specifically, noise generated from radiation in the detector and front-end electronics in star trackers can degrade the performance of the sensors. Upsets in the related processing electronics can cause loss of track, data interruptions, and in some cases, failure to recover. Degradation of performance can occur in a natural charged-particle environment and becomes worse in a weapon-enhanced radiation environment. High total dose results in component and, in turn, system failure to operate. The objectives of this program, which was conducted by Ball Aerospace Systems Division (BASD) for the Naval Research Laboratory (NRL), were to develop a tracker that could survive a high total dose and to gain a better understanding of the transient effects of radiation on the star tracker performance. Survivability of the star tracker in a radiation environment, both at the component level and at the system level, is of primary importance. GRA

N86-21567# Ball Aerospace Systems Div., Boulder, Colo.
RADIATION-HARD BREADBOARD STAR TRACKER. ATTACHMENT 1 Final Report
M. W. Hubbard and D. L. Murata Sep. 1985 140 p
(Contract N00014-82-6(C)-2488)
(AD-A162778; BASD/F85-03-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

The Final Report on a radiation-hard breadboard star tracker discusses the following topics: Star Tracker Control Program listing; flowhcart of the Star Tracker Control Program; Data Input Program listing, Command Output Program listing; PlOTXY Program Listing; and error messages. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-21568 Stanford Univ., Calif.
SIMULATION OF MOTIONS OF SATELLITES CARRYING A DEPLOYABLE FLEXIBLE LINKAGE Ph.D. Thesis
Shlomo Djerassi 1985 143 p
Avail: Univ. Microfilms Order No. DA8522130

Numerical simulations based upon equations governing the motion of a rigid body supporting a deployable flexible linkage that carries a rigid load are used to study spacecraft control. However, since existing methods for the formulation of equations of motion do not lend themselves well for this purpose, one must extend these methods in order to come into position to undertake numerical simulations. The central idea underlying the extension is that equations of motion of a system of bodies subject to constraints can be obtained by temporarily disregarding the constraints, writing expressions for generalized inertia forces and for generalized active forces associated with the unconstrained system, and then using these together with coefficients appearing in the constraint equations to generate a set of equations of motion of the original system. Certain arrays, called Z arrays, are introduced in connection with the derivation of constraint equations associated with elastic bodies arranged in closed kinematical loops. Use of these arrays makes it possible to let the linkage have any number of links. The legitimacy of modal representation of the elastic deformation of a typical link is discussed in view of the fact that the link is subjected to an unknown time-varying shear load. Several studies are performed to illustrate the behavior of the system with a variety of initial conditions, parameters, and number of modes used to describe elastic deflections. These studies indicate that in-orbit deployment can be obtained passively, and that, in certain applications, weight reduction of the links can be sustained without affecting the dynamic behavior of the system, as far as inplane motions are concerned. Dissert. Abstr.

N86-21569*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DYNAMIC CHARACTERISTICS OF TWO 300 kW CLASS DUAL KEEL SPACE STATION CONCEPTS
John T. Dorsey, Thomas R. Sutter, Mark S. Lake, and Paul A. Cooper Feb. 1986 50 p refs
(NASA-TM-87680; NAS 1.15:87680) Avail: NTIS HC A03/MF A01 CSCL 22B

Results from an investigation of the dynamic behavior of a 300 kW class solar dynamic powered, dual kell space station are presented. The purpose of the investigation was to determine and assess the influence of space station truss bay size on station controllability during rigid body attitude adjustment and orbit reboost maneuvers. The dual keel space station concept is defined and two finite element models (one which has a truss bay size of 5m and another with a truss bay size of 9 feet) are described. Rigid and flexible body characteristics of the two space station models are also presented. Finally, results from a transient response analysis, where the stations are subjected to an orbit reboost maneuver, are summarized. Author

N86-21570# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TV-SAT FINAL ORBIT ACQUISITION OPTIMIZATION STRATEGY
Valder MatosdeMedeiros and A. F. Leibold Oct. 1985 14 p refs Presented at the International Conference Space Dynamics for Geostationary Satellites, Toulouse, France, 28-30 Oct., 1985
(INPE-3679-PRE/829) Avail: NTIS HC A02/MF A01

This work describes the strategy for the final station acquisition for three-axis stabilized geostationary satellite with solar constraints, which affect the allowed position maneuvers. The least cost for this purpose is got when apsidal line lies on the outside of the boundary layer of the constraints and the three-impulse Hohmann transfer is possible to perform, but, when this does not happen, maneuvers can not be performed at the apsidal and a four-impulse strategy is necessary. For this purpose, one software program was developed. The basic formulation for applying Linear Programming Methods to the computation of optimal guidance correction during the station acquisition process of a geostationary satellite has been proposed by Hechler (1). However, the problem to pick the proper set of right ascensions for possible orbit corrections has not been satisfactory solved, particulary for the case of prescribed maneuver-free orbit determination periods between the correction impulses. A second work (3) was done based on the results of this last work and uses set of four-split impulse strategy from the three-maneuver Hohmann transfer. The present work suggests a more general strategy, getting four impulse optimized solution for this problem. Results obtained for TV-SAT case simulation with a mission and conclusions are included. Author

N86-21571# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS OF THE CAPTURE OF THE NOMINAL EQUILIBRIUM POSITION FOR THE FIRST BRAZILIAN SATELLITE
Paulo TadeudeMeloLourencao and Donizete Leonel Ferreira Oct. 1985 13 p refs Presented at the 4th Japan-Brazil Symposium on Science and Technology, held at Sao Jose dos Campos, Brazil, Aug. 1984
(INPE-3694-PRE/839) Avail: NTIS HC A02/MF A01

This work presents the study of the capture of the equilibrium position for the first Brazilian satellite after obtaining the kinetic, gravitational potential and elastic potential energies for the Lagrangean equations of motion. This system of equations is hybrid, nonautonomous, coupled and nonlinear, thus making an analytical approach not feasible. Performing simplifications on the modelling of the appendages and using the assumed modes method for the elastic displacements, the distributed parameters and the hybrid

character of the set of equations are eliminated. Then, by numerical integration the attitude motion during and after the transient phase of the appendages deployment are established. The initial conditions in which the capture is possible are studied, by considering a large variation of parameters like deployment velocity, position of center of mass, moments and products of inertia, bending rigidity, etc. Author

N86-21572# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PARAMETER OPTIMIZATION AND ATTITUDE STABILIZATION OF A FLEXIBLE SPACECRAFT
Decio Castilho Ceballos Oct. 1985 10 p refs Presented at the International Conference Space Dynamics for Geostationary Satellites, Toulouse, France, 28-30 Oct. 1985
(INPE-3680-PRE/830) Avail: NTIS HC A02/MF A01

This paper describes the synthesis and analysis of a control law for a flexible spacecraft. The control law is considered a simple proportional, integral, and derivative law together with a second order structural filter. Parameter optimization is applied for finding the controller parameters, so as to have an optimized behavior when applied to the high order model. Frequency and Laplace domain analysis are shown, which indicate the satisfactory behavior of the proposed controller. Author

N86-21573# General Electric Co., Schenectady, N. Y.
DEVELOPMENT OF SPACECRAFT MATERIALS AND STRUCTURES FUNDAMENTALS Final Scientific Report, 1 Jun. 1984 - 31 May 1985
S. Prochazka and S. L. Dole Aug. 1985 87 p
(Contract F49620-83-C-0101)
(AD-A161338; SRD-85-021; AFOSR-85-0974TR) Avail: NTIS HC A05/MF A01 CSCL 11/2

Compacts of boron carbide powders with specific surface area = or > 8 sq m/g were sintered in argon at temperatures near 2200C. Several of these powders were prepared by attrition milling of abrasive grade boron carbide. Densification to 95+% of theoretical density could be obtained only with compositions that had appropriate amounts of excess carbon. The microstructures were fine grained and uniform but underwent abnormal grain growth above 2235C accompanied by transgranular microcracking. This grain growth could be inhibited by increasing the carbon content. Mechanical damping capacity was measured by the free beam and cantilevered beam techniques on boron carbide and other materials. Methods to enhance the damping capacity in a beam structure were analyzed. The flexural strength of sintered boron carbide was evaluated and related to powder processing and sintering parameters. Author (GRA)

N86-21574# Sandia National Labs., Albuquerque, N. Mex.
PROTOTYPE RECOVER SYSTEM HARDWARE AND SOFTWARE REVIEW AND FUTURE REMOTE MONITORING SYSTEM PHILOSOPHY. POTAS TASK E.59 REMOTE MONITORING DESIGN REVIEW
W. C. Fienning and F. A. Bailey Sep. 1985 12 p
(Contract DE-AC04-76DP-00789)
(DE86-001681; SAND-83-2618; ISPO-207) Avail: NTIS HC A02/MF A01

This report describes the first phase of Task E.59 of the Program for Technical Assistance to IAEA Safeguards (POTAS). It contains a design review of the existing prototype RECOVER equipment and preliminary recommendations for an operational, remote monitoring system. The principal conclusions of the design review are related to the limitations of the prototype system regarding communications efficiency and operator interactions. To a large extent, the limitations are a result of the initial RECOVER system conceptual design, and perhaps more importantly, to the technology available when the system was developed. The preliminary recommendations are aimed at eliminating, to the maximum extent possible, the aforementioned limitations through the use of the suggested concepts and current state-of-the-art technology. These recommendations are intended to provide the basis for follow-on Task E.59 activities leading to a detailed conceptual design, including specifications, of an operational, remote monitoring system. Efforts leading to such a design would commence after the overall utility and cost effectiveness of remote monitoring are defined in terms of ultimate routine use of such a system by the IAEA. DOE

N86-21887*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
EXPERIMENTAL MEASUREMENT OF MATERIAL DAMPING FOR SPACE STRUCTURES
Edward F. Crawley and Raymond L. Sheen *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 18 p refs Sponsored in part by US Air Force (For primary document see N86-21883 12-39)
(Contract NAGw-21)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21904# Rockwell International Corp., Downey, Calif.
STRUCTURAL DAMPING OF SHUTTLE ORBITER AND ASCENT VEHICLES
D. L. Jensen *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 13 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21905# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
MEASURED DAMPING OF SHUTTLE ACOUSTIC TEST STRUCTURES
C. E. Wallace, Mark Mielke, and Jack Joanides (Rockwell International, Downey, Calif.) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 13 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-21575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF A SPACECRAFT INSTRUMENT BALL BEARING ASSEMBLY LUBRICATED BY A PERFLUOROALKYLETHER
Wilfredo Morales, William R. Jones, Jr., and Donald H. Buckley Mar. 1986 9 p refs
(NASA-TM-87260; E-2885; NAS 1.15:87260) Avail: NTIS HC A02/MF A01 CSCL 22B

An analysis of a spacecraft instrument ball bearing assembly, subjected to a scanning life test, was performed to determine the possible case of rotational problems involving these units aboard several satellites. The analysis indicated an ineffective transfer of a fluorinated liquid lubricant from a phenolic retainer to the bearing balls. Part of the analysis led to a novel HPLC separation method employing a fluorinated mobile phase in conjunction with silica based size exclusion columns. Author

N86-22471# Danish Space Research Inst., Lyngby.
INSTRUMENTATION FOR X-RAY SPECTROSCOPY
Herbert W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 77-86 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-21576 Marconi Space Systems Ltd., Portsmouth (England).
SPACECRAFT PROPULSION SYSTEMS MASS MODELLING STUDY: ASSUMPTIONS AND DEFINITIONS
Sep. 1984 40 p
Copyright. Avail: Issuing Activity

A computer model and program structure for the generation of a versatile and quick method of determining the spacecraft, launch vehicle, and in particular, the propulsion system requirements of any low Earth orbit or geostationary orbit mission are described. The program is designed for an HP-9826 computer. Author (ESA)

N86-21577*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGY FOR BAYTON-CYCLE POWERPLANTS USING SOLAR AND NUCLEAR ENERGY
Robert E. English Feb. 1986 15 p refs
(NASA-TP-2558; E-2761; NAS 1.60:2558) Avail: NTIS HC A02/MF A01 CSCL 10B

Brayton cycle gas turbines have the potential to use either solar heat or nuclear reactors for generating from tens of kilowatts to tens of megawatts of power in space, all this from a single technology for the power generating system. Their development for solar energy dynamic power generation for the space station could be the first step in an evolution of such powerplants for a very wide range of applications. At the low power level of only 10 kWe, a power generating system has already demonstrated overall efficiency of 0.29 and operated 38 000 hr. Tests of improved components show that these components would raise that efficiency to 0.32, a value twice that demonstrated by any alternate concept. Because of this high efficiency, solar Brayton cycle power generators offer the potential to increase power per unit of solar collector area to levels exceeding four times that from photovoltaic powerplants using present technology for silicon solar cells. The technologies for solar mirrors and heat receivers are reviewed and assessed. This Brayton technology for solar powerplants is equally suitable for use with the nuclear reactors. The available long time creep data on the tantalum alloy ASTAR-811C show that such Brayton cycles can evolve to cycle peak temperatures of 1500 K (2240 F). And this same technology can be extended to generate 10 to 100 MW in space by exploiting existing technology for terrestrial gas turbines in the fields of both aircraft propulsion and stationary power generation. Author

N86-21578*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A BIBLIOGRAPHY OF ELECTROTHERMAL THRUSTER TECHNOLOGY, 1984
James S. Sovey, Terry L. Hardy, and Matthew Englehart (Paper Basics, Brookpark, Ohio) Mar. 1986 49 p
(NASA-TM-86998; E-2536; NAS 1.15:86998) Avail: NTIS HC A03/MF A01 CSCL 21C

Electrothermal propulsion concepts are briefly discussed as an introduction to a bibliography and author index. Nearly 700 citations are given for resistojets, thermal arcjets, pulsed electrothermal thrusters, microwave heated devices, solar thermal thrusters, and laser thermal thrusters. Author

N86-21579*# Software and Engineering Associates, Inc., Carson City, Nev.
PERFORMANCE PREDICTIONS FOR AN SSME CONFIGURATION WITH AN ENLARGED THROAT
G. R. Nickerson and L. D. Dang Nov. 1985 44 p
(Contract NAS8-35931)
(NASA-CR-178740; NAS 1.26:178740; SN-63) Avail: NTIS HC A03/MF A01 CSCL 21H

The Two Dimensional Kinetics (TDK) computer program that was recently developed for NASA was used to predict the performance of a Large Throat Configuration of the Space Shuttle Main Engine (SSME). Calculations indicate that the current design SSME contains a shock wave that is induced by the nozzle wall shape. In the Large Throat design an even stronger shock wave is predicted. Because of the presence of this shock wave, earlier performance predictions that have neglected shock wave effects have been questioned. The JANNAF thrust chamber performance prediction procedures given in a reference were applied. The analysis includes the effects of two dimensional reacting flow with a shock wave. The effects of the boundary layer with a regeneratively cooled wall are also included. A Purdue computer program was used to compute axially symmetric supersonic nozzle flows with an induced shock, but is restricted to flows with a constant ratio of specific heats. Thus, the TDK program was also run with ths assumption and the results of the two programs were compared. Author

N86-21580# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF SWIRLING AIR FLOWS ON THE COMBUSTION PROPERTIES OF A SOLID FUEL RAMJET MOTOR M.S. Thesis
William H. Campbell, Jr. Sep. 1985 71 p
(AD-A161382) Avail: NTIS HC A04/MF A01 CSCL 21/2

A series of reacting flow tests of a solid fuel ramjet were conducted with different air inlet swirl. Cold flow measurements of the air flow at the exit plane of the tube-in-hole injector were used to determine the Swirl Number for each configuration. Regression rates of the HTPB fuel at low air mass flux were found to increase with swirl vane angle (and Swirl Number) up to 30 degrees. GRA

N86-21581# Calspan Field Services, Inc., Arnold AFS, Tenn.
TEST FIXTURE EFFECTS IN VIBRATION TESTS OF ROCKET MOTORS Final Report, 1 Nov. 1982 - 1 May 1983
C. J. Welsh Nov. 1985 27 p Sponsored by Air Force
(AD-A161403; AEDC-TR-85-42) Avail: NTIS HC A03/MF A01 CSCL 21/8

An analysis was made of acceleration response measurements of solid-propellant rocket motors in vibration testing at the Arnold Engineering Development Center. In this type of testing, an electrodynamic shaker is utilized to provide the desired oscillatory driving force, and a test fixture is required to adapt the motor to the shaker. Although a test fixture can contribute adverse effects on the rocket motor motions for some conditions in vibration testing, the results of the analysis indicate that large undesirable rocket motor acceleration responses may be measured and invalidly attributed to the test fixture used. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-21582* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PERFLUORO (IMIDOYLAMIDINE) DIAMIDINES Patent
Robert W. Rosser, Timothy S. Chen (San Jose State Univ., Calif.), and Chung-Heng Cheng, inventors (to NASA) (San Jose State Univ., Calif.) Issued 28 Jan. 1986 6 p Filed 5 Jun. 1985 Continuation of US-Patent-Appl-SN-528777, filed 2 Sep. 1983, abandoned, which is a division of US-Patent-Appl-SN-366025, filed 6 Apr. 1982, US-Patent-4,434,106
(NASA-Case-ARC-11402-3; US-Patent-4,567,301; US-Patent-Appl-SN-741405; US-Patent-Class-564-243) Avail: US Patent and Trademark Office CSCL 07C

Perfluoroether triazine elastomers having improved properties

are prepared from oligomeric imidoylamidines that were in turn, prepared by the process of: (1) reacting a perfluorodinitrile with liquid ammonia to yield a perfluorodiamidine, (2) isolating the perfluorodiamidine, (3) reacting the isolated diamidine with a perfluorodinitrile to yield a perfluoro(imidoylamidine) dinitrile, and then repeating the steps to sequentially grow an oligomer of desired molecular size. The isolated amidine and nitrile intermediates are also disclosed. The elastomers can be fashioned into seals, gaskets, and sealing components and the like.
Official Gazette of the U.S. Patent and Trademark Office

N86-21583*# National Aeronautics and Space Administration, Washington, D.C.
SYNTHESIS OF PYROMELLITIC ACID ESTERS
V. A. Fedorova, V. A. Donchak, and A. N. Martynyuk-Lototskaya Dec. 1985 6 p refs Transl. into ENGLISH from Journal of the Lvov Polytechnic Inst. (USSR), v. 139, 1980 p 31-33 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77977; NAS 1.15:77977; ISSN-0460-0436) Avail: NTIS HC A02/MF A01 CSCL 07C

The ester acids necessary for studyng the thermochemical properties of pyromellitic acid (PMK)-based peroxides were investigated. Obtaining a tetramethyl ester of a PMK was described. The mechanism of an esterification reaction is discussed, as is the complete esterification of PMK with primary alcohol. Author

N86-21584*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHEMICAL BONDING TECHNOLOGY: DIRECT INVESTIGATION OF INTERFACIAL BONDS
J. L. Koenig, F. J. Boerio, E. P. Plueddemann, J. Miller, P. B. Willis, and E. F. Cuddihy Jan. 1986 54 p refs
(JPL Proj. 5101-284; Contract DE-AI01-85CE-89008)
(NASA-CR-176657; JPL-PUB-86-6; DOE/JPL-1012-120; NAS 1.26:176657) Avail: NTIS HC A04/MF A01 CSCL 07C

This is the third Flat-Plate Solar Array (FSA) Project document reporting on chemical bonding technology for terrestrial photovoltaic (PV) modules. The impetus for this work originated in the late 1970s when PV modules employing silicone encapsulation materials were undergoing delamination during outdoor exposure. At that time, manufacturers were not employing adhesion promoters and, hence, module interfaces in common with the silicone materials were only in physical contact and therefore easily prone to separation if, for example, water were to penetrate to the interfaces. Delamination with silicone materials virtually vanished when adhesion promoters, recommended by silicone manufacturers, were used. The activities related to the direct investigation of chemically bonded interfaces are described. Author

N86-21585# International Union of Pure and Applied Chemistry, Vienna (Austria).
THE 12TH INTERNATIONAL CONFERENCE ON ORGANOMETALLIC CHEMISTRY HELD AT CONGRESS CENTER HOFBURG, VIENNA ON 8-13 SEPTEMBER 1985. ABSTRACTS
1985 582 p Conference held at Vienna, Austria, 8-13 Sep. 1985
(AD-A161039) Avail: NTIS HC A25/MF A01 CSCL 07/3

This document contains abstracts of papers presented at the 12th International Conference on Organometallic Chemistry. GRA

N86-21586# Naval Ship Research and Development Center, Annapolis, Md.
AN EXPERIMENTAL EVALUATION OF THE EFFECTS OF SELECTED ORGANIC COMPOUNDS ON THE FORMATION OF INSOLUBLES IN DIESEL FUELS Final Report
John G. Zimmerman Nov. 1985 101 p
(Contract N61533-82-M-2379; Z08-38)
(AD-A161323; Z1-83; DTNSRDC/SME-CR-12-83) Avail: NTIS HC A06/MF A01 CSCL 21/4

The study documents and interrelates five experimental programs conducted by the David Taylor Naval Ship Research and Development Center in-house and under contract. The programs were designed to increase understanding of the effects of eleven selected heterocompounds on the stability of diesel-range fuels. The programs employed any or all of four different stability tests ranging from an oven test conducted at 150 F (65.6) for periods up to eight weeks to a test which exposed the fuel to a temperature of 500 F (260 C) for a few seconds. Ranking of the fuels and fuel mixes by all of the tests was reasonably consistent. The nature of the base fuel was important in determining the amount of sediment formed in the presence of a given heterocompound. Of the nine compounds individually tested, 2,5-dimethylpyrrole (DMP) and 1,2,5-trimethylpyrrole produced the greatest amounts of sediment, and 2- methylpiperazine (MPPZ), 1-dodecanethiol (DDSH), and 2,6-di-tert-butylphenol the least. Also, DDSH over a range of concentrations showed a synergistic effect in the presence of a constant level of DMP. In a synergistic effect in the presence of a constant level of DMP. In contrast, MPPZ inhibited the formation of sediment in the presence of an equivalent concentration of DMP. A number of sediment mass versus time curves gave evidence of an inducation period. Curves of sediment mass versus compound concentration was roughly linear. GRA

N86-21587# North Carolina Univ., Chapel Hill.
NEIGHBORING GROUP PARTICIPATION IN SOLVOLYSIS OF ORGANOSULFUR AND RELATED COMPOUNDS Final Report, 1 Sep. 1982 - 31 Aug. 1984
Ernest L. Eliel 31 Aug. 1985 7 p
(Contract DAAG29-82-K-0184)
(AD-A161458; ARO-19625.5-CH) Avail: NTIS HC A02/MF A01 CSCL 07/3

This investigation involved exploring in detail participation of sulfur (and, in less detail, that of oxygen) in solvolysis reactions via four-membered cyclic intermediates. This has been achieved. In the process some potentially interesting observations concerning solvent and salt effects in these reactions have been recorded.
Author (GRA)

N86-21588# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
A STUDY OF THE MECHANISM OF POPULATION OF HIGH LYING ROTATIONAL STATES IN HYDROGEN HALIDES Final Report, May 1982 - May 1985
Eric Weitz 30 Aug. 1985 16 p
(Contract DAAG29-82-K-0125)
(AD-A161460; ARO-18596.4-CH) Avail: NTIS HC A02/MF A01 CSCL 07/4

The production of vibrationally excited HCl was carried out either by photodissociation of HCl with an ArF laser with the dissociation initial step followed by recombination or by photoelimination of HCl from a variety of chloroethylenes. Relaxation rates of vibrationally excited HCl in liquid Xe or Kr were determined. Highly rotationally excited HF produced via photoelimination of HF from C2H5F was investigated. GRA

N86-21589# Defence Research Establishment Valcartier (Quebec).
COMPLEXES OF NITROCELLULOSE WITH CUPRIC CHLORIDE
E. Ahad Nov. 1985 27 p
(AD-A162519; DREV-R-4384/85) Avail: NTIS HC A03/MF A01 CSCL 07/3

The cupric chloride (CC) effect on the viscosity of nitrocellulose (NC) in an acetone solution was studied for various military and commercial type NC samples obtained from different suppliers. The NC samples were produced from wood cotton cellulose with a nitrogen content between 11.0 and 13.5% and a molecular weight ranging from 20,000 to 800,000. The study was carried out using different NC and CC concentrations and at different shear rates. The addition of CC to the NC solution causes an increase of the viscosity as a function of time due to the complex formation between NC and CC which is accomplished in two stages, each with a specific rate constant. The variation of the viscosity with the shear rate followed a pseudoplastic non-Newtonian behaviour. An empirical factor, the Cupric Chloride Parameter

(CCP), is computer from the intrinsic viscosity of the polymer as weight fraction of CC relative to NC, X, determined at the saturation point. The CCP is characgteristic of the NC sample and cna be related to the cellulose source (wood or cotton) and nitrogen content. The value of the square root of X* can be used as a parameter ot elucidate structural differences among NC samples. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N86-21590* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH PERFORMANCE MIXED BISIMIDE RESINS AND COMPOSITES BASED THEREON Patent
John A. Parker, Alvin H. Heimbuch, Ming-ta S. Hsu (HC Chem Research and Service Corp., San Jose, Calif.), and Timothy S. Chen, inventors (to NASA) (HC Chem Research and Service Corp., San Jose, Calif.) Issued 4 Feb. 1986 8 p
(NASA-Case-ARC-11538-1SB; US-Patent-4,568,733; US-Patent-Appl-SN-719796; US-Patent-Class-526-262) Avail: US Patent and Trademark Office CSCL 11D

Mixtures of bismaleimide/biscitraconirnide resins produces materials which have better handling, processing or mechanical and thermal properties, particularly in graphite composites, than materials made with the individual resins. The mechanical strength of cured graphite composites prepared from a 1:1 copolymer of such bisimide resins is excellent at both ambient and elevated temperatures. The copolymer mixture provides improved composites which are lighter than metals and replace metals in many aerospace applications.
Official Gazette of the U.S. Patent and Trademark Office

N86-21591 Pennsylvania State Univ., University Park.
FATIGUE RESPONSE OF SILICON CARBIDE WHISKER/ALUMINUM MATRIX COMPOSITES Ph.D. Thesis
Balakrishna Korukonda 1985 169 p
Avail: Univ. Microfilms Order No. DA8516047

The present study addresses the fatigue response of silicon carbide whisker reinforced aluminum alloy (SiC sub w/6061-F) at room temperature (25 C) as well as at elevated temperatures up to 250 C. Material variables studied were limited to volume fraction of reinforcement. Field variables examined were temperature and applied stress range. Experimental results were compared to those expected for the unreinforced alloy in the as-fabricated, or -F, condition, as well as to those for the alloy in its optimal fatigue resistance state,-T6. At 25 C, 6061-F reinforced with 10 V%, 20 V%, and 30 V%SiC exhibited improved endurance over the 6061-F material in the unreinforced condition. However, improvements in endurance over the strengthened alloy from 6061-T6 were displayed only by composites with 20 V% and 30 V% reinforcement. Improvements in fatigue endurance were analytically found to be attributable to load sharing by the reinforcement fibers. Elevated temperature fatigue endurance up to 123 C indicated that the reinforced alloy was superior to the same alloy without ceramic content. Dissert. Abstr.

N86-21592# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Composite Materials and Structures.
PROCEEDINGS OF THE SECOND ANNUAL REVIEW OF THE CENTER FOR COMPOSITE MATERIALS AND STRUCTURES
Apr. 1985 346 p refs Review held in Blacksburg, Va., 23-24 Apr. 1985
Avail: NTIS HC A15/MF A01

Topics covered include: finite element models; geometric analysis; failure analysis of graphite-epoxy laminates; fracture mechanics; modeling cured laminates; edge reinforcement concepts; nondestructive testing; impact damage to thick composite laminates; and prediction analysis techniques. For individual titles, see N86-21593 through N86-21613.

N86-21593# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DEVELOPMENT OF HIGH ORDER FINITE ELEMENTS TO MODEL FILAMENT WOUND COMPOSITES
C. A. Rogers, C. E. Knight, Jr., and W. G. Dodge *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 10 p refs (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

Analysis of filament wound composite structures is typically very complex, and in order to accomplish a reasonable analysis, considerable detail of the fabrication pattern of the winding process usually must be incorporated. The application of the finite element method to the analysis and design of filament wound composite structures makes what would normally be an untractable problem into one that can be solved. Because a large number of equations exist, the data input and computer computation time are consequently large also. In order to develop a design oriented analysis capability which could produce accurate results quickly with reduced input-data requirements, the total number of system equations must be reduced. A single high displacement order finite element was used to model the through thickness of a composite laminate. The displacement order for the in-plane direction remains linear, while the through thickness order is user selectable. Numerical integration for stiffness is evaluated with respect to the various material properties and laminar thicknesses in each individual element. Author

N86-21594*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
DESIGN OF NOTCHED PLATES UNDER COMPRESSION
Zafer Guerdal and Raphael T. Haftka *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 21 p refs Sponsored in part by NASA (For primary document see N86-21592 12-24)
(Grant NAG1-168)
Avail: NTIS HC A15/MF A01 CSCL 11D

A failure criterion for notched plates in compression was developed. The criterion is based on experimentally observed kinking failure of fibers around a notch combined compressive and shear stresses. Experimental results for plates with a crack or a hole are used to verify the failure model, and design studies are performed to demonstrate the use of the model. Author

N86-21595# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ANALYSIS OF ALUMINUM/ARAMID-EPOXY HYBRID LAMINATES
D. A. Hirschfeld and C. T. Herakovich *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 16 p refs Sponsored in part by Aluminum Co. of America, Alcoa Center, Pa. (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

Composite laminates made of Armaid fiber reinforced epoxy sandwiched between Aluminum sheets (Al) have the potential for being ideal structural materials in many engineering applications. This is because they combine the strength and elastoplastic isotropic behavior of Al with the high strenght-to-weight ratio and fatigue resistance of the Aramid-epoxy composite plies (AR). The inplane engineering properties and interlaminar stresses that can cause delamination are studied. Included is a discussion of the relationship between the interlaminar stresses and the mismatch of engineering properties between layers. This relationship can be a good indicator of the conditions yielding maximum interlaminar stresses. Prediction of inplane elastic and thermal properties were made assuming that the properties of 7075-T6 Al (0.012 in thick) and AR (0.008 in thick) are known and that classical lamination theory is valid. The properties were predicted as a function of fiber orientation. Typical elastic laminate properties and thermal laminate properties were plotted. Author

N86-21596# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

GEOMETRIC AND MATERIAL NONLINEAR BENDING ANALYSIS OF LAMINATED COMPOSITE PLATES AND SHELLS
K. Chandrashekhara and J. N. Reddy *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 22 p refs Sponsored in part by Army (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

A finite element displacement model is developed for geometric and material nonlinear analysis of laminated plates and shells. The material model is based on the incremental theory of plasticity with modified Hill's anisotropic yield condition and the associated flow rule. The strain hardening is assumed to be isotropic since the applied load is restricted to monotonic application. The method accounts for the fact that the parameters of anisotropy vary as the material strain hardens. Layered element approach is adopted for the treatment of plastic behavior through the thickness. The finite element is based on an extension of Sander's shell theory and accounts for the von Karman strains and transverse shear strains. A number of sample problems showing the effects of geometric and/or material nonlinearities on deflections and stresses in plates and shells are presented. Author

N86-21597# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
RESPONSE AND FAILURE ANALYSIS OF A GRAPHITE-EPOXY LAMINATE CONTAINING TERMINATING INTERNAL PLIES
Brian L. Kemp (Johns Hopkins Univ., Laurel, Md.) and Eric R. Johnson *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 42 p refs Previously announced in IAA as A85-30226 (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

A change in laminate thickness due to terminating internal plies acts as a stress riser for both intralamina and interlamina stresses. This laminate configuration is referred to as a ply drop. The linear elastic, three-dimensional stress distributions in the vicinity of a ply drop are determined for a graphite-epoxy laminate subject to axial tension and compression by a finite element analysis. It is shown that the interlaminar stresses have a maximum magnitude at the ply drop-off, and decrease proceedings away from the drop. The interlaminar stresses vanish in regions sufficiently removed from the ply drop-off. Two modes of failure initiation are analyzed. In the pure resin regions surrounding the dropped plies, the maximum stress criterion is assumed to govern failure. The Tsai-Wu criterion is used for intralamina failure prediction. The influence of two laminate lay-ups and a variety of ply drop geometries on the response and failure are presented. Author

N86-21598*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THERMALLY INDUCED STRESSES AND DEFORMATIONS IN LAYERED COMPOSITE TUBES
D. E. Cooper (Virginia Polytechnic Inst. and State Univ., Blacksburg), D. Cohen (Virginia Polytechnic Inst. and State Univ., Blacksburg), C. Q. Rousseau (Virginia Polytechnic Inst. and State Univ., Blacksburg), M. W. Hyer (Virginia Polytechnic Inst. and State Univ., Blacksburg), and S. S. Tompkins *In* Virginia Polytechnic Inst. and State Univ. Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 37 p Sponsored in part by NASA (For primary document see N86-21592 12-24)
(Grant NAG1-343)
Avail: NTIS HC A15/MF A01 CSCL 11D

The thermally induced stresses and deformations in layered, orthotropic tubes are studied. The motivation for studying tubes is their likely application for use in space structures. Tubes are a strong candidate for this application because of their high structural efficiency, as measured by stiffness per unit weight, and their relative ease of fabrication. Also, tubes have no free edges to deteriorate or delaminate. An anticipated thermal condition for tubes in space is a circumferential temperature gradient. This type of gradient will introduce dimensional changes into the structure and may cause stresses large enough to cause damage to the material. There are potentially large differences in temperatures at different circumferential locations on the tube. Because of this, the effects of temperature dependent material properties on the stresses and deformations may be important. The study is composed of three parts: experiments to determine the functional form of the circumferential gradient and to measure tube deflections; an elasticity solution to compute the stresses and deformations; and an approximate approach to determine the effects of temperature dependent material properties. Author

N86-21599*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FRACTURE MORPHOLOGY OF 2-D CARBON-CARBON COMPOSITION
William B. Avery and Carl T. Herakovich *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 4 p Sponsored in part by NASA (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Out-of-plane tensile tests of a woven fabric carbon-carbon composite were performed in a scanning electron microscope equipped with a tensile stage and a videotape recording system. The composite was prepared from T-300 8-harness satin graphite fabric and a phenolic resin. The (0/90/0/90/0 sub 1/2) sub 2 laminate, with a Theta describing the orientation of the warp fibers of the fabric, was cured at 160 C and pyrolized at 871 C. This was followed by four cycles of resin impregnation, curing, and pyrolysis. A micrograph of the cross section of the composite is presented. Inspection of the specimen fracture surface revealed that the filaments had no residual matrix bonded to them. Further inspection revealed that the fracture was interlaminar in nature. Failure occurred where filaments of adjacent plies had the same orientation. Thus it is postulated that improvement in transverse tensile strength of 2-D carbon-carbon depends on the improvement of the filament-matrix bond strength. Author

N86-21600*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
MODELING THE CURING PROCESS OF THICK-SECTION AUTOCLAVE CURED COMPOSITES
Alfred C. Loos and Philip H. Dara *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 23 p Sponsored in part by NASA (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Temperature gradients are significant during cure of large area, thick-section composites. Such temperature gradients result in nonuniformly cured parts with high void contents, poor ply compaction, and variations in the fiber/resin distribution. A model was developed to determine the temperature distribution in thick-section autoclave cured composites. Using the model, long with temperature measurements obtained from the thick-section composites, the effects of various processing parameters on the thermal response of the composites were examined. A one-dimensional heat transfer model was constructed for the composite-tool assembly. The governing differential equations and associated boundary conditions describing one-dimensional unsteady heat-conduction in the composite, tool plate, and pressure plate are given. Solution of the thermal model was obtained using an implicit finite difference technique. B.G.

N86-21601*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
COMPOSITE LAMINATE FREE EDGE REINFORCEMENT CONCEPTS
W. E. Howard, Terry Gossard, Jr., and Robert M. Jones *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 27 p Sponsored in part by NASA (For primary document see N86-21592 12-24)
(Grant NAG1-389)
Avail: NTIS HC A15/MF A01 CSCL 11D

The presence of a free edge in a laminated composite structure can result in delamination of the composite under certain loading

conditions. Linear finite element analysis predicts large or even singular interlaminar stresses near the free edge. Edge reinforcements which will reduce these interlaminar stresses, prevent or delay the onset of delaminations, and thereby increase the strength and life of the structure were studied. Finite element models are used to analyze reinforced laminates which were subsequently fabricated and loaded to failure in order to verify the analysis results. Author

N86-21602*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

VISCOELASTIC BEHAVIOR AND LIFE-TIME PREDICTIONS

D. A. Dillard and H. F. Brinson *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 10 p Sponsored in part by NASA (For primary document see N86-21592 12-24)

Avail: NTIS HC A15/MF A01 CSCL 11D

Fiber reinforced plastics were considered for many structural applications in automotive, aerospace and other industries. A major concern was and remains the failure modes associated with the polymer matrix which serves to bind the fibers together and transfer the load through connections, from fiber to fiber and ply to ply. An accelerated characterization procedure for prediction of delayed failures was developed. This method utilizes time-temperature-stress-moisture superposition principles in conjunction with laminated plate theory. Becaus.. failures are inherently nonlinear, the testing and analytic modeling for both moduli and strength is based upon nonlinear viscoelastic concepts. B.G.

N86-21603*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE DYNAMIC RESPONSE OF COMPOSITE BEAMS TO AXIAL IMPACT

E. J. Derian (Virginia Polytechnic Inst. and State Univ., Blacksburg), M. W. Hyer (Virginia Polytechnic Inst. and State Univ., Blacksburg), and H. D. Carden *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 11 p ref Sponsored in part by NASA (For primary document see N86-21592 12-24)

(Grant NAG1-343)

Avail: NTIS HC A15/MF A01 CSCL 11D

Large deformation response of simple composite structural elements to intense dynamic loadings is studied by focusing on the response of beams. Overall goals are to: design a simple test fixture to introduce crash related bending loads in beams; determine any difference between large deformation static and large deformation dynamic response; determine the influence of laminate stacking arrangements on the dynamic response, failure mode, and energy absorbed; and predict the dynamic response. Twelve different laminate orientations were investigated. Modeling of the response was done with an existing finite element program. The program computed nonlinear transient response analysis of a structure objected to a time varying load. B.G.

N86-21604*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.

NONDESTRUCTIVE EVALUATION OF COMPOSITES BY OPTICAL TIME DOMAIN REFLECTOMETRY

R. O. Claus, D. D. Bennette, and B. S. Jackson *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 15 p Sponsored in part by NASA (For primary document see N86-21592 12-24)

Avail: NTIS HC A15/MF A01 CSCL 11D

Results in the measurement of slowly varying mechanical loading functions on composites using optical time domain reflectometry (OTDR) in imbedded optical fiber during both simulated manufacture and use are reviewed. First, the basic theoretical and experimental principles of the OTDR system are described. Next, the mechanical system of the composite and the imbedded fiber is analyzed. Results of measurement obtained for various loading functions applied to material specimens are then described and system limitations on spatial resolution, strain amplitude sensitivity, and frequency response are explained in terms of the range and resolution limits of the OTDR system. Author

N86-21605# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

BOUNDARY LAYER EFFECTS IN NEARLY INCOMPRESSIBLE CRACKED BODIES

C. W. Smith and O. Olaosebikan *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 7 p refs (For primary document see N86-21592 12-24)

(Grant NSF SMP-83-20252)

Avail: NTIS HC A15/MF A01

After briefly reviewing an experimental method which integrates the methods of frozen stress photoelasticity and high density moire interferometry together with appropriate algorithms for estimating three dimensional distributions of fracture parameters was focused upon. Results obtained by the method pertaining to boundary effects and their possible interpretation within the context of linear elastic fracture mechanics are stressed. Author

N86-21606# National Bureau of Standards, Boulder, Colo. Fracture and Deformation Div.

INFLUENCE OF DAMAGE ON MECHANICAL PERFORMANCE OF WOVEN LAMINATES AT LOW TEMPERATURE Abstract Only

Ronald D. Kriz and Walter J. Muster (Swiss Federal Laboratories for Materials Testing and Research, Debendorf, Switzerland) *In* Virginia Polytechnic Inst. and State Univ. Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 1 p (For primary document see N86-21592 12-24)

Avail: NTIS HC A15/MF A01

Large quantities of nonmetallic woven composites will be used in magnetic fusion energy structures at low temperatures. The influence of crack formation on the mechanical performance of standard glass/epoxy laminates (G-10CR, G-11CR) at low temperatures were predicted and measured. Mechanics of the load deformation response of a unit cell of weave was predicted by a finite element model that assumes generalized plane strain. Damage was modeled as macrocracks confined to individual fiber bundles that were oriented transverse to the tensile load direction. From experiments with tension loads, the formation of damage as a collection of fiber breaks, fiber bundle cracks, and delaminations between adjacent fiber bundles was studied. Author

N86-21607*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A FRACTURE MECHANICS ANALYSIS OF IMPACT DAMAGE IN A THICK COMPOSITE LAMINATE Abstract Only

C. C. Poe, Jr. *In* Virginia Polytechnical Inst. and State Univ. Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 1 p Sponsored in part by NASA (For primary document see N86-21592 12-24)

Avail: NTIS HC A15/MF A01 CSCL 11D

Graphite/epoxy filament-wound cases (FWC) for the solid rocket motors of the space shuttle are being made by NASA. The FWC cases are wound with AS4W graphite fiber impregnated with an epoxy resin and are about 1.4 inches or more thick. Graphite-epoxy composite laminates, unlike metals, can be damaged easily by low velocity impacts of objects like dropped tools. The residual tension strength of the FWC laminate, after impact, is being studied at Langley Research Center. The conditions that give minimum visual evidence of damage are being emphasized. A fracture mechanics analysis was developed to predict the residual strength, after impact, using radiographs to measure the size of the damage and an equivalent surface crack to represent the damage. Author

N86-21608# Virginia Polytechnic Inst. and State Univ., Blacksburg. Materials Response Group.

LIFE PREDICTION FOR COMPOSITE LAMINATES USING CRITICAL ELEMENT CONCEPTS

W. W. Stinchcomb and K. L. Reifsnider *In its* Proceedings of the

2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 14 p refs Sponsored in part by AF and General Dynamics, Fort Worth, Tex. (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

The critical element model was used to predict residual strength and life of a variety of graphite-epoxy laminates subjected to tension-tension, compression-compression, tension-compression, and block loading conditions. The model predictions were compared with experimental results from an extensive test program using thick, graphite-epoxy laminates. Author

N86-21609# Virginia Polytechnic Inst. and State Univ., Blacksburg. Materials Response Group.
NDE OF COMPOSITE MATERIALS USING ULTRASOUND: QUANTITATIVE OPTICAL DETECTION
A. Sarrafzadeh and C. J. Duke, Jr. *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 19 p refs (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

Two optical set-ups for detection and measurement of acoustic surface displacements produced by stress waves are presented. An optical displacement sensor based on speckle interferometry is designed so that both in-plane and out-of-plane components of disturbance caused by stress waves propagating in the material substrate can be detected and measured. A two beam interferometric system based on the diffraction grating application and single-mode-fiber optic utilization in measuring displacement amplitude of ultrasonic waves was designed. Schematic diagrams of such optical sensors presently under investigation are included. Author

N86-21610*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Materials Response Group.
RESPONSE OF THICK, NOTCHED LAMINATES SUBJECTED TO TENSION-COMPRESSION CYCLIC LOADS
C. E. Bakis and W. W. Stinchcomb *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 12 p Presented at the ASTM Symposium on Composite Materials: Fatigue and Fracture, Dallas, Tex., 24-25 Oct. Sponsored in part by NASA (For primary document see N86-21592 12-24)
(Grant NAG1-343)
Avail: NTIS HC A15/MF A01 CSCL 11D

The fatigue response of a [(0/24/90/-45)s]4 T300-5208 graphite-epoxy laminate with a drilled centerhole subjected to fully reversed tension-compression (R=-1, T-C) constant amplitude loading was investigated. Damage evaluation techniques such as stiffness monitoring, penetrant-enchanced X-ray radiography, C-scan, laminate deeply and residual strength were used to establish the mechanisms of damage development as well as the relations between this damage and the stiffness, strength and life of the laminate. Damage initiated at the hole as matrix cracking parallel to the fibers in all plies. Matrix cracks had a significant effect on delamination initiation and growth. Delaminations initiated near the surface in the densely cracked region at the hole and grew along major matrix cracks. Compressive properties degraded more rapidly than tensile properties. At the stress levels used, residual tensile strength increased early in the fatigue life and remained approximately constant to near the end of life, when failure was precipitated by excessive laminate instability during the compressive portion of the loading. Author

N86-21611*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FRACTURE OF THICK GRAPHITE/EPOXY LAMINATES WITH PART-THROUGH SURFACE FLAWS
D. H. Morris and C. E. Harris *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 11 p refs Sponsored in part by NASA (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Fracture behavior of tensile specimens containing through-the-thickness flaws and part-through semi-elliptic surface flaws was investigated. The material was T300/5208 graphite/epoxy, with a stacking sequence [0/+ or - 45/90] sub ns. Laminate thicknesses ranged from 8 to 120 plies. Fracture toughness for specimens with through-the-thickness flaws was a function of laminate thickness. Fracture toughness was also independent of crack size. Fracture toughness for the thick laminates was also independent of specimen geometry (center-cracked tension specimen, compact tension specimen, and three-point bend specimen). Using the asymptotic value of facture toughness and linear elastic isotropic fracture mechanics, the notched strength of tensile specimens with semi-elliptic surface flaws was predicted. The strength ratio is a function of the flaw depth (a/t) and flaw aspect (a/c) ratios. Comparisons between predicted and experimental strengths are good for large values of a/t. The notched strength of filament wound graphite/epoxy tensile specimens with part-through surface flaws was also predicted. Author

N86-21612*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
CHARACTERIZATION OF CARBON FIBERS AND FIBER-MATRIX ADHESION IN COMPOSITES
James P. Wightman and T. A. DeVilbiss *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 17 p Sponsored in part by NASA (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

The effect of fiber/matrix interactions on the mechanical properties of thermoplastic carbon fiber composites was determined. The experimental approach was a multi-faceted one involving the following areas: characterization of the surface of carbon fibers using X-ray photoelectron spectroscopy (XPS), secondary ion mass spectroscopy (SIMS) and scanning transmission electron microcopy (STEM); determination of the functional groups on carbon fiber surfaces using an elemental tagging scheme - derivatization; determination of the polar and dispersion contribution to the surface energy of carbon fibers by measuring wetting forces in a series of liquids having known polar and dispersion components; and study of the interaction of thermoplastic polymers with carbon surfaces by solution adsorption, STEM and fiber critical length. Author

N86-21613# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry and Chemical Engineering.
CHEMICAL MODIFICATION OF MATRIX RESIN NETWORKS WITH ENGINEERING THERMOPLASTICS: MORPHOLOGY AND PROPERTIES OF POLY(ARYL ETHER SULFONE) MODIFIED EPOXY NETWORKS
J. L. Hedrick, I. Yilgor, J. C. Hedrick, G. L. Wilkes, and J. E. McGrath *In its* Proceedings of the 2nd Annual Review of the Center for Composite Materials and Structures Apr. 1985 13 p refs Previously announced in IAA as A86-13133 Sponsored in part by Navy (For primary document see N86-21592 12-24)
Avail: NTIS HC A15/MF A01

Epoxy resins were modified with functionally terminated poly(aryl ether sulfone) oligomers to improve fracture toughness, while still essentially maintaining the bulk flexural modulus. Phenolic hydroxyl terminated polysulfone oligomers were first capped with a large molar excess of Epon Resin 828 to chemically link the ductile, glassy modifier. The resulting system was cured with a stoichiometric amount of diaminodiphenyl sulfone to form a network structure in a two step process. The molecular weights and the amount of polysulfone chemically incorporated into the network were varied and their effect on several important physical properties were investigated. The dynamic mechanical analysis and microscopy (SEM) studies show that it is possible to form a two phase morphology wherein the polysulfone composite particles are dispersed in the epoxy network matrix. Despite the two phase structure, the modified crosslinked systems are nearly transparent, apparently due to a similarity in refractive index values. The fracture toughness of these modified networks under plane strain condi-

tions improved significantly with minimal sacrifice of the flexural modulus and modulus-temperature profile. Author

N86-21614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATED COMPOSITE ANALYZER (ICAN): USERS AND PROGRAMMERS MANUAL
Pappu L. N. Murthy and Christos C. Chamis Mar. 1986 77 p refs
(NASA-TP-2515; E-2035; NAS 1.60:2515) Avail: NTIS HC A05/MF A01 CSCL 11D

The use of and relevant equations programmed in a computer code designed to carry out a comprehensive linear analysis of multilayered fiber composites is described. The analysis contains the essential features required to effectively design structural components made from fiber composites. The inputs to the code are constituent material properties, factors reflecting the fabrication process, and composite geometry. The code performs micromechanics, macromechanics, and laminate analysis, including the hygrothermal response of fiber composites. The code outputs are the various ply and composite properties, composite structural response, and composite stress analysis results with details on failure. The code is in FORTRAN IV and can be used efficiently as a package in complex structural analysis programs. The input-output format is described extensively through the use of a sample problem. The program listing is also included. The code manual consists of two parts. Author

N86-21615# B and M Technological Services, Inc., Cambridge, Mass.
STATE-OF-THE-ART REVIEW ON COMPOSITE MATERIAL FATIGUE/DAMAGE TOLERANCE Final Report, Jul. - Nov. 1984
Reginald L. Amory and David S. Wang Dec. 1985 81 p refs
(Contract DTFA03-84-C-00052)
(FAA/CT-85/7; FAA-84-03-F) Avail: NTIS HC A05/MF A01

A state of the art review on composite material fatigue/damage tolerance was conducted to investigate the literature for fatigue life prediction methodologies including stress based methodologies, strength degradation models, and damage growth models. A critical review was made of each methodology and its commensurate basic equations of importance. Experimental data were reviewed and the behavior of specimens was correlated with that of civil aircraft components. Six recognized methods for the nondestructive testing of fibrous composite materials were examined and the most effective methods identified. Author

N86-21616*# National Aeronautics and Space Administration, Washington, D.C.
THE EFFECTS OF SURFACE FINISH AND GRAIN SIZE ON THE STRENGTH OF SINTERED SILICON CARBIDE
Young Hyuk You, Young Wook Kim, June Gunn Lee, and Chong Hee Kim Oct. 1985 12 p refs Transl. into ENGLISH from Journal of the Korean Ceramic Society (Seoul, South Korea), v. 21, no. 1, 1984 p 27-32 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77871; NAS 1.15:77871) Avail: NTIS HC A02/MF A01 CSCL 11D

The effects of surface treatment and microstructure, especially abnormal grain growth, on the strength of sintered SiC were studied. The surfaces of sintered SiC were treated with 400, 800 and 1200 grit diamond wheels. Grain growth was induced by increasing the sintering times at 2050 C. The beta to alpha transformation occurred during the sintering of beta-phase starting materials and was often accompanied by abnormal grain growth. The overall strength distributions were established using Weibull statistics. The strength of the sintered SiC is limited by extrinsic surface flaws in normal-sintered specimens. The finer the surface finish and grain size, the higher the strength. But the strength of abnormal sintering specimens is limited by the abnormally grown large tabular grains. The Weibull modulus increases with decreasing grain size and decreasing grit size for grinding. Author

N86-21617*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF THICKNESS AND PLY ORIENTATION ON BUCKLING OF LAMINATED PLATES
Dawn C. Jegley Feb. 1986 16 p ref
(NASA-TM-87691; NAS 1.15:87691) Avail: NTIS HC A02/MF A01 CSCL 11D

The buckling loads of laminated plates are predicted using a new theory which takes into account transverse shearing effects. This new theory assumes trigonometric terms through-the-thickness in the displacements to take into account transverse shearing effects in thick plates. Buckling loads predicted by the new theory and by traditional theories are compared for isotropic and laminated plates. The effect of ply orientation on the buckling loads predicted by each theory is demonstrated. Author

N86-21618*# Delaware Univ., Newark. Coll. of Engineering.
DELAMINATION GROWTH IN COMPOSITE MATERIALS
John W. Gillespie, Jr., Leif A. Carlsson, R. Byron Pipes, Robert Rothschilds, Bruce Trethewey, and Anthony Smiley Feb. 1986 212 p refs
(Grant NAG1-475)
(NASA-CR-178066; NAS 1.26:178066) Avail: NTIS HC A10/MF A01 CSCL 11D

The Double Cantilever Beam (DCB) and the End Notched Flexure (ENF) specimens are employed to characterize MODE I and MODE II interlaminar fracture resistance of graphite/epoxy (CYCOM 982) and graphite/PEEK (APC2) composites. Sizing of test specimen geometries to achieve crack growth in the linear elastic regime is presented. Data reduction schemes based upon beam theory are derived for the ENF specimen and include the effects of shear deformation and friction between crack surfaces on compliance, C, and strain energy release rate, G sub II. Finite element (FE) analyses of the ENF geometry including the contact problem with friction are presented to assess the accuracy of beam theory expressions for C and G sub II. Virtual crack closure techniques verify that the ENF specimen is a pure Mode II test. Beam theory expressions are shown to be conservative by 20 to 40 percent for typical unidirectional test specimen geometries. A FE parametric study investigating the influence of delamination length and depth, span, thickness and material properties on G sub II is presented. Mode I and II interlaminar fracture test results are presented. Important experimental parameters are isolated, such as precracking techniques, rate effects, and nonlinear load-deflection response. It is found that subcritical crack growth and inelastic materials behavior, responsible for the observed nonlinearities, are highly rate-dependent phenomena with high rates generally leading to linear elastic response. Author

N86-21619*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THERMOPLASTIC MATRIX COMPOSITE PROCESSING MODEL
Philip H. Dara and Alfred C. Loos Sep. 1985 151 p refs
(Grant NAG1-343)
(NASA-CR-176639; NAS 1.26:176639; VPI-E-85-21; IR-57) Avail: NTIS HC A08/MF A01 CSCL 11D

The effects the processing parameters pressure, temperature, and time have on the quality of continuous graphite fiber reinforced thermoplastic matrix composites were quantitatively accessed by defining the extent to which intimate contact and bond formation has occurred at successive ply interfaces. Two models are presented predicting the extents to which the ply interfaces have achieved intimate contact and cohesive strength. The models are based on experimental observation of compression molded laminates and neat resin conditions, respectively. Identified as the mechanism explaining the phenomenon by which the plies bond to themselves is the theory of autohesion (or self diffusion). Theoretical predictions from the Reptation Theory between autohesive strength and contact time are used to explain the effects of the processing parameters on the observed experimental strengths. The application of a time-temperature relationship for autohesive strength predictions is evaluated. A viscoelastic compression molding model of a tow was developed to explain

the phenomenon by which the prepreg ply interfaces develop intimate contact. Author

N86-21620# California Univ., Los Angeles. School of Engineering and Applied Science.
STRESS-STRAIN BEHAVIOR AND FAILURE OF UNIAXIAL COMPOSITES IN COMBINED COMPRESSION AND SHEAR - 1 Interim Technical Report
S. B. Batdorf and Robert W. C. Ko 1 Jul. 1985 19 p
(Contract N00014-77-C-0505)
(AD-A161772; UCLA-ENG-85-25) Avail: NTIS HC A02/MF A01 CSCL 11/4

The effects of increasing fiber tilt with increasing load in uniaxial composites, culminating in kink band formation is considered. The fibers themselves are assumed to remain elastic. Nonlinearities result from changing fiber tilt and yielding of the matrix. Compressive stress-strain relations and failure are treated from a unified viewpoint. Comparisons are made between theory and experiment. GRA

N86-21621# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FATIGUE PROPERTIES OF MULTIDIRECTIONAL BRAIDED COMPOSITES Final Report
L. W. Gause, J. M. Alper, and R. H. Dalrymple Feb. 1985 42 p
(WRO-2303)
(AD-A162572; AD-E900528; NADC-85022-60) Avail: NTIS HC A03/MF A01 CSCL 11/4

The fatigue performance of graphite/epoxy composites manufactured using a general braiding process was evaluated. Two styles of braided composites were fabricated and tested. Style I was the basic (1 x 1) braid pattern. Style II was constructed by holding half of the yarns as straight columns and braiding the rest of the yarns about the fixed yarns. Performance was compared to a 24 ply conventional laminate. Tension-tension, compression-compression and fully reversed constant amplitude fatigue tests were performed. Both style braids exhibited similar behavior, except style II had longer compression-compression fatigue life. As expected, in all fatigue conditions the braids had shorter lives than the baseline laminate. Nonetheless, the fatigue threshold stress levels observed for the braids as a percent of ultimate strength were similar to current laminated construction design stress values. GRA

N86-21622# Georgia Inst. of Tech., Atlanta.
ANALYSIS AND EXPERIMENTS ON INTERLAMINAR FRACTURE TOUGHNESS IN RESIN MATRIX COMPOSITES Final Scientific Report, 1 Jan. 1983 - 14 Apr. 1985
Lawrence W. Rehfield, Erian A. Armanios, and Ambur D. Reddy Jul. 1985 56 p
(Grant AF-AFOSR-0056-83)
(AD-A162689; AFOSR-85-1075TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

This final report summarizes the objectives, accomplishments and proposed new direction of research on mode II interlaminar fracture in resin matrix composites. A mode II interlaminar fracture specimen, test and analysis method for interpreting results have been successfully developed and demonstrated for the AS4/3502 material system. Experimental data have been obtained under both net tensile and compressive loading. Of considerable importance are the findings that: (1) the AS4/3502 material system show increasing resistance to crack growth in tension; (2) interlaminar fracture under compression is a totally unstable process; and (3) tension and compression behaviors are considerably different. The findings and the conclusions that are drawn from them point to new, promising directions. Complementary experiments on low cycle fatigue in tension and compression and on mode I suppression in tension have been performed. The former basically confirm the static findings. The latter illustrate the potential effectiveness of mode I suppression technology and help to clarify mixed mode fracture. GRA

N86-21623# Ohio State Univ., Columbus.
BUCKLING OF LAMINATED COMPOSITE PLATES AND SHELL PANELS Final Report, 20 Nov. 1980 - 20 Jan. 1985
Arthur W. Leissa Jun. 1985 456 p
(Contract F33615-81-K-3203)
(AD-A162723; OSURF-762513/713464; AFWAL-TR-85-3069) Avail: NTIS HC A20/MF A01 CSCL 11/4

The technical literature dealing with buckling and post-buckling behavior of laminated composite plates and shell panels is summarized. Emphasis is given to modern materials used in the aerospace industry having fiber-matrix constituents (e.g., glass-epoxy, boron-epoxy, graphite-epoxy, boron-aluminum), but other applications are also considered (e.g., plywood, paperboard). Geometric configurations taken up are either flat (plates) or cylindrically curved (shells), and have rectangular planform. All possible types of loading conditions and edge constraint conditions are considered. Both symmetrically and unsymmetrically laminated configurations are included, with symmetrical laminates represented by orthotropic or anisotropic plate or shell theory. Complicating effects dealt with include: internal holes, shear deformation, sandwich plates with soft cores, local instability, inelastic materials, hygrothermal effects and stiffeners. Extension numerical results are presented in graphical and tabular form. Both theoretical and experimental results are summarized. Author (GRA)

N86-21624# University Coll. of North Wales, Bangor. Dept. of Physics.
AN EVALUATION AND PREPARATION OF FERROMAGNETIC LIQUID COMPOSITES FOR USE AT MILLIMETER WAVELENGTHS Annual Report, 21 Dec. 1982 - 30 Oct. 1985
J. Popplewell, J. P. Llewellyn, and P. Davies Oct. 1985 78 p
(Contract DAJA45-83-C-0026; DA Proj. 1L1-61102-BH-57)
(AD-A162753; R/D-4130-MS-01; AR-2) Avail: NTIS HC A05/MF A01 CSCL 20/3

Ferrofluid composites containing polystyrene, tin, copper, aluminum, carbon and silver particles 1 to 50 micron in diameter have been prepared by dispersing the articles in ferrofluids with M s = 400 to 800 G. Thin film samples 1 micron to 1 mm thick have been studied using a 3 mm microwave source and Fourier Transform Spectrometry. Large microwave absorptions (60%) which are induced by small fields of less than 100 Oe have been observed in thin film composites containing metal particles. Magnetic absorptions arise from chain formation in composition and this has been modelled using Monte-Carlo simulations. Good agreement between the observations and theoretical predictions is obtained. GRA

N86-21625# Department of the Air Force, Washington, D.C.
A NEW NDE METHOD FOR COATED CARBON-CARBON COMPOSITES Patent Application
Robert L. Crane, inventor (to Air Force) Filed 5 Sep. 1985 12 p
(AD-D011978; US-Patent-Appl-SN-772815) Avail: NTIS HC A02/MF A01 CSCL 11/3

This document describes a non-destructive technique for detecting and repairing surface flaws in the silicon carbide oxidation resistant coating of a carbon-carbon composite. The surface of the composite is treated with a test liquid consisting essentially of a carrier fluid, a particulate pigment and a finely divided borosilicate glass, or a mixture of silicon dioxide and boron oxide, containing 0.25 to 8 weight percent boron oxide. The treated surface is inspected for surface flaws. Any discovered flaws are repaired by heating the surface to cause the borosilicate glass to flow and heal the flaw. The composite is thereafter heated to a further elevated temperature to deplete the boron from the flaw sealing glass. Author (GRA)

N86-21626# Oxford Univ. (England). Dept. of Engineering Science.
BEHAVIOUR OF FIBRE-REINFORCED COMPOSITES UNDER DYNAMIC TENSION
K. Saka and J. Harding 1985 73 p refs
(Grant AFOSR-84-0092)
(OUEL-1602/85) Avail: NTIS HC A04/MF A01

Epoxy specimens reinforced with plain-weave fabrics of carbon or glass or with several hybrid combinations of the two in various lay-ups, giving 5 different weight fractions of reinforcement from all-carbon to all-glass, were tested in tension at an impact strain rate of 1000/sec. Dynamic stress-strain curves are derived and the effect of hybrid weight fraction on the modulus, the tensile strength, the strain to fracture, and the energy absorbed during the fracturing process is determined. The fracture surfaces were examined by optical and scanning electron microscopy and the failure process in the hybrid composites is related to that found in the all-carbon and the all-glass specimens. Results for tests on similar specimens at an intermediate tensile strain rate of 10/sec are presented. Analytical expressions which relate the strength and stiffness of the hybrid specimens to the properties of the constituent plies and the lamination parameters are derived.
Author (ESA)

N86-21725# Joint Publications Research Service, Arlington, Va.
FIBER REINFORCED PLASTICS DESCRIBED
In its Japan Report: Science and Technology (JPRS-JST-86-001) 10 Jan. 1986 p 19-42 Transl. into ENGLISH from Nikko Materials (Tokyo, Japan), Jan. 1985 p 85-96 (For primary document see N86-21723 12-31)
Avail: NTIS HC A04/MF A01

N86-21897# Manhattan Coll., New York. Dept. of Mechanical Engineering.
MATERIAL DAMPING OF CARBON/EPOXY COMPOSITES BY MEANS OF FREE-FREE BEAM RESONANCE TESTS
Daniel W. Haines *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 16 p refs Sponsored in part by the Celanese Corp. (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21898# Idaho Univ., Moscow.
IMPROVEMENT OF DAMPING IN FIBER REINFORCED POLYMER COMPOSITES
R. F. Gibson, S. A. Suarez, and L. R. Deobald *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 20 p refs (For primary document see N86-21883 12-39)
(Grant AF-AFOSR-0156-83)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21899# Naval Surface Weapons Center, Silver Spring, Md.
DYNAMIC MECHANICAL PROPERTIES OF GRAPHITE/ALUMINUM WIRES AT AUDIOFREQUENCIES
Gilbert F. Lee and Clifford W. Anderson *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 15 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21900# Martin Marietta Aerospace, Denver, Colo.
DAMPING BEHAVIOR OF METAL MATRIX COMPOSITES
M. S. Misra and P. D. LaGreca *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 12 p refs Sponsored in part by Martin Marietta Aerospace (For primary document see N86-21883 12-39)
(Contract F33615-82-R-3222A)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21901# National Bureau of Standards, Boulder, Colo. Fracture and Deformation Div.
DAMPING IN METAL-MATRIX COMPOSITES: MEASUREMENT AND MODELING
H. M. Ledbetter and S. K. Datta (Colorado Univ., Boulder) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 17 p refs Sponsored in part by DARPA (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-22490# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
CARBON-FIBER REINFORCED EPOXY TECHNIQUES FOR THE X-RAY MULTIMIRROR MISSION (XMM) LOW-ENERGY (LE) TELESCOPES
P. A. J. deKorte (Space Research Lab., Leiden), J. Klug, G. Moreau (Instruments SA, France), and G. P. Whitcomb (ESA/ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 189-193 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-21627*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRICAL PHOTOSEMICONDUCTING AND PARAMAGNETIC PROPERTIES OF POLYPYROMELLITIMIDES
V. S. Voishchev, O. V. Kolninov, T. A. Gordina, B. V. Komov, B. I. Sazhin, B. I. Mikhantev, and A. N. Pravednikov Dec. 1985 7 p refs Transl. into ENGLISH from Vysokomolekuliarnye Soedineniia, Series B (USSR), v. 16, no. 4, 1974 p 295-298 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77975; NAS 1.15:77975) Avail: NTIS HC A02/MF A01 CSCL 07D

Semiconducting properties with dark and photoconductivity, type r, were observed in polypyromellitimides (PPMI) and explained by a donor-acceptor interreaction in the PPMI between electron acceptor promellitimide fragments and electron donor diamide in adjacent macromolecules.
Author

N86-21628*# National Aeronautics and Space Administration, Washington, D.C.
STUDIES ON THE OXIDATION OF HEXAMETHYLBENZENE 1: OXIDATION OF HEXAMETHYLBENZENE WITH NITRIC ACID
Koji Chiba, Shinya Tomura, and Toshiyuki Mizuno Feb. 1986 10 p Transl. into ENGLISH from Nippon Kagaku Kaishi (Japan), no. 10, 1973 p 1959-1962 Presented at the Tohoku Regional Session of the Japan Chemical Association, Part One, Japan, Oct. 1972 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77945; NAS 1.15:77945) Avail: NTIS HC A02/MF A01 CSCL 07D

The oxidative reaction of hexamethylbenzene (HMB) with nitric acid was studied, and the hitherto unknown polymethylbenzenepolycarboxylic acids were isolated: tetramethylphthalic anhydride, tetramethylisophthalic acid, 1,3,5-, 1,2,4- and 1,2,3-trimethylbenzenetricarboxylic acids. When HMB was warmed with 50% nitric acid at about 80 C, tetramethylphthalic anhydride and tetramethylisophthalic acid were initially produced. The continued reaction led to the production of trimethylbenzenetricarboxylic acids, but only slight amounts of dimethylbenzenetetracarboxylic acids were detected in the reaction mixture. Whereas tetramethylphthalic anydride and tetramethylisophthalic acid were obtained, pentamethylbenzoic acid, a possible precursor of them, was scarcely produced. On the other hand, a yellow material extracted with ether from the initial reaction mixture contained bis-(nitromethyl)prehnitene (CH3)4C6(CH2NO2)2, which was easily converted into the phthalic anhydride.
Author

N86-21629*# National Aeronautics and Space Administration, Washington, D.C.
STUDIES ON THE OXIDATION OF HEXAMETHYLBENZENE 2: PREPARATION OF DIMETHYLPYROMELLITIC ACID
Koji Chiba and Shinya Tomura Feb. 1986 10 p Transl. into ENGLISH from Nippon Kagaku Kaishi (Japan), no. 11, 1973 p 2188-2190 Presented at the Tohoku Regional Session of the Japan Chemical Association, Part One, Japan, Oct. 1972 Transl.

by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77946; NAS 1.15:77946) Avail: NTIS HC A02/MF A01 CSCL 07D

Hexamethylbenzene (HMB) was difficult to be oxidized with an alkaline potassium permanganate solution, since HMB was insoluble in an aqueous alkaline solution. But, when HMB was warmed with 50% nitric acid for a short time, and then treated with aqueous potassium permanganate, the reaction occurred readily and dimethylpyromellitic acid was obtained. When HMB was warmed with 50% nitric acid for 1 to 2 minutes, a yellow material was produced, which was soluble in hot aqueous potassium hydroxide, though free from carboxylic acids. It contained a little amount of bis-(nitromethyl)prehnitene and several unknown compounds. Further, the heat stability of polyimide prepared by the reaction of tetramethyldimethylpyromellitate with 4,4 prime-diaminodiphenylmethane turned out to be nearly equal to that of polyimide prepared from tetramethylpyromellitate. Author

N86-21630*# National Aeronautics and Space Administration, Washington, D.C.
EXPERIMENTAL STUDIES ON THE REACTION KINETICS OF 1,1-DIMETHYLHYDRAZINE AND OXYGEN
Th. Just Nov. 1985 24 p refs Transl. into ENGLISH of "Experimentlle Untersuchungen zur Kinetik der Reaktion von 1.1-Dimethylhydrazin mit Sauerstoff" rept. DLF-FB-70-34 DFVLR, Cologne-Porz, West Germany, Aug. 1970 p 1-26 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-77947; NAS 1.15:77947) Avail: NTIS HC A02/MF A01 CSCL 07D

Measurements behind shock waves in highly diluted 1,1 dimethylhydrazine-O2-Ar mixtures clearly showed a two-stage reaction. In the first stage, UDMH decomposes via a unimolecular step; in the second stage, clearly separated from the first one, the decay products react further with O2. Values for the rate constant of unimolecular decomposition were obtained. Author

N86-21631*# National Aeronautics and Space Administration, Washington, D.C.
CHARGE TRANSFER COMPLEXES OF CERTAIN AROMATIC POLYIMIDES
T. A. Gordina, B. V. Kotov, O. V. Kolninov, and A. N. Pravednikov Dec. 1985 9 p refs Transl. into ENGLISH from Vysokomolekulyarnyye Soyedineniya (USSR), V. 15, Series B, 1973 p 378-381 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77974; NAS 1.15:77974) Avail: NTIS HC A02/MF A01 CSCL 07D

By electron spectroscopy it was shown that aromatic polyimides containing electron-donor residues of diamines -C6H4-X-C6H- {X=NH, NCH3, NC6H5, O, S, and CH2) form charge transfer complexes with low-molecular-weight electron acceptors. Based on the data obtained, the hypothesis was advanced that the coloration of the polyimides per se is due to the formation of charge transfer complexes between the electron-acceptor imide fragments and the electron-donor residues of the diamines. Author

N86-21632*# National Aeronautics and Space Administration, Washington, D.C.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE DESTRUCTION OF GRAPHITES IN A FLOW OF DISSOCIATED AIR
T. A. Bovina, Yu. V. Zviagin, N. V. Markelov, and Yu. V. Chudetskiy Feb. 1986 10 p refs Transl. into ENGLISH of "Teoreticheskoye i Eksperimentalnoye Issledovaniye Razrucheniya Grafitov v Potoke Dissotsiirovannogo Vozdukha" presented at Heat and Mass Transfer 5: 5th All-Union Conference on Heat and Mass Transfer, 1976 p 85-90 Conference held in Minsk, USSR, 17-20 May 1976 Original language document was announced in IAA as A77-43935 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
Avail: NTIS HC A02/MF A01 CSCL 07D

A method is presented for calculating the heating and erosion of blunt bodies made of graphite in a high-enthalpy flow of dissociated air, assuming chemical equilibrium on the surface and taking account of the thermal effects of combustion and sublimation of graphite. The analysis involves the use of a finite difference scheme to solve an equation of unsteady heat conduction. Attention is given to the equilibrium vaporization of C, C2 and C3 molecules. The calculations agree well with experimental data for a wide range of temperatures and stagnation pressures. B.J.

N86-21633*# National Aeronautics and Space Administration, Washington, D.C.
EXPERIMENTAL STUDY OF THE THERMAL STABILITY OF MATERIALS IN HIGH TEMPERATURE OXYGEN-CONTAINING MEDIA
Y. Ye. Abaltusov, A. R. Bagramyan, A. M. Grishin, and V. I. Yukhvid Mar. 1986 5 p refs Transl. into ENGLISH from Fizika Goreniya i Vzryva (USSR), v. 17, Jan. - Feb. 1981 p 147-148 Original language document was announced in IAA as A81-28022 Transl. by Scientific Translation Service, Santa Barbara, Calif.
Avail: NTIS HC A02/MF A01 CSCL 07D

An experimental study is made of the interaction of several materials with a high temperature medium containing oxygen. The temperature of the surface was measured as a function of time. It is found that the higher the velocity of mass removal from the surface, the more effective is the material from the viewpoint of heat resistance. Author

N86-21634*# National Aeronautics and Space Administration, Washington, D.C.
DETERMINATION OF NITROGEN MONOXIDE IN HIGH PURITY NITROGEN GAS WITH AN ATMOSPHERIC PRESSURE IONIZATION MASS SPECTROMETER
Kenji Kato et al Nov. 1985 16 p refs Trasnl. into ENGLISH from Bunseki Kagaku (Janan), v. 31, no. 1, 1982 p 22-27 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77959; NAS 1.15:77959) Avail: NTIS HC A02/MF A01 CSCL 07D

An atmospheric pressure ionization mass spectrometric (API-MS) method was studied for the determination of residual NO in high purity N2 gas. The API-MS is very sensitive to NO, but the presence of O2 interferes with the NO measurement. Nitrogen gas in cylinders as sample gas was mixed with NO standard gas and/or O2 standard gas, and then introduced into the API-MS. The calibration curves of NO and O2 has linearity in the region of 0 - 2 ppm, but the slopes changed with every cylinder. The effect of O2 on NO+ peak was additive and proportional to O2 concentration in the range of 0 - 0.5 ppm. The increase in NO+ intensity due to O2 was (0.07 - 0.13)%/O2, 1 ppm. Determination of NO and O2 was carried out by the standard addition method to eliminate the influence of variation of slopes. The interference due to O2 was estimated from the product of the O2 concentration and the ratio of slope A to Slope B. Slope A is the change in the NO+ intensity with the O2 concentration. Slope B is the intensity with O2 concentration. Author

N86-21635*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHANE OXIDATION BEHIND REFLECTED SHOCK WAVES: IGNITION DELAY TIMES MEASURED BY PRESSURE AND FLAME BAND EMISSION
Theodore A. Brabbs and Thomas F. Robertson (Case Western Reserve Univ., Cleveland, Ohio) [1986] 23 p refs Presented at the Central States Meeting of the Combustion Inst., Cleveland, Ohio, 5-6 May 1986
(NASA-TM-87268; E-2956; NAS 1.15:87268) Avail: NTIS HC A02/MF A01 CSCL 21B

Ignition delay data were recorded for three methane-oxygen-argon mixtures (phi = 0.5, 1.0, 2.0) for the temperature range 1500 to 1920 K. Quiet pressure trances enabled us to obtain delay times for the start of the experimental pressure rise. These times were in good agreement with those obtained from the flame band emission at 3700 A. The data correlated well with the oxygen and methane dependence of Lifshitz, but showed a much stronger

temperature dependence (phi = 0.5 delta E = 51.9, phi = 1.0 delta = 58.8, phi = 2.0 delta E = 58.7 Kcal). The effect of probe location on the delay time measurement was studied. It appears that the probe located 83 mm from the reflecting surface measured delay times which may not be related to the initial temperature and pressure. It was estimated that for a probe located 7 mm from the reflecting surface, the measured delay time would be about 10 microseconds too short, and it was suggested that delay times less than 100 microsecond should not be used. The ignition period was defined as the time interval between start of the experimental pressure rise and 50 percent of the ignition pressure. This time interval was measured for three gas mixtures and found to be similar (40 to 60 micro sec) for phi = 1.0 and 0.5 but much longer (100 to 120) microsecond for phi = 2.0. It was suggested that the ignition period would be very useful to the kinetic modeler in judging the agreement between experimental and calculated delay times. Author

N86-21636*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHEMISTRY OF MOS-LSI RADIATION HARDENING Final Report
P. Grunthaner 15 Aug. 1985 88 p refs Prepared for Defense Nuclear Agency, Washington, D.C.
(Contract NAS7-918)
(NASA-CR-176651; JPL-PUB-85-77; NAS 1.26:176651) Avail: NTIS HC A05/MF A01 CSCL 07D

The objective of this task was to obtain chemical information on MOS test samples. Toward this end, high resolution X-ray photoemission spectroscopy (XPS) has been the primary techniques used to characterize the chemistry and structure of the SiO2/Si interface for a variety of MOS structures with differing degrees of susceptibility to damage by ionizing radiation. The major accomplishments of this program are: (1) the identification of a structurally distinct region of SiO2 in the near-interfacial region of thermal SiO2 on Si; (2) the identification in the near-interfacial region of SiO2 structural differences between radiation hard and soft gate oxides; (3) the direct observation of radiation-induced damage sites in thermal SiO2 with XPS using in situ electron stress; (4) the correlation of suboxide state distributions at the SiO2/Si interface with processing parameters and radiation susceptibility; (5) the development of a chemical mechanism for radiation-induced interface state generation in SiO2/Si structures; and (6) the development benign chemical profiling techniques which permit the investigation of oxide/semiconductor structures using surface sensitive electron spectroscopic techniques. Author

N86-21637# Environmental Devices Corp., Sacramento, Calif.
COINCIDENTAL CHEMICAL SIGNATURE IDENTIFIER Final Report
1985 20 p
(Contract F04704-84-C-0072)
(AD-A161269) Avail: NTIS HC A02/MF A01 CSCL 07/4

In our proposal, we hypothesized that an individual possesses distinguishable characteristics, inherent in his chemical makeup, that differentiates him from all other people. The Phase 1 research was concerned with how existing analytical chemical instrumentation could assist in deciphering vapors emitted by humans which could result in a positive chemical identification signature. In the Phase 1 feasibility research study, we evaluated and tested methods for collecting, cataloguing and identifying human effluent vapors that were characteristic and unique to the individual. A variety of temperatures, enclosures, flow rates, filters and sample traps were used in the collection of vapors from three female and two male subjects in an attempt to distinguish one spectrum from another. Analysis of specimen was via the Olfax I mass spectrometer. It was found that all our subjects' spectra were comprised of essentially the same chemical compounds, with varying abundances. The two subjects, (1 male, 1 female), most frequently and thoroughly tested, revealed nominal mass intensity ratios for 53% of the mass numbers usually monitored in our studies differing by more than 20% from the paired spectrum. These differences suggest that distinguishing characteristics do exist from person to person and that given the proper tools and sufficient time, an instrument can be developed to meet military and commercial security requirements. GRA

N86-21638# Pennsylvania State Univ., University Park.
STUDIES OF GAS-PHASE CLUSTERS: APPLICATION TO NUCLEATION AND AEROSOL FORMATION Final Report, Aug. 1982 - Jul. 1985
A. W. Castleman, Jr. 25 Sep. 1985 35 p
(Contract DAAG29-82-K-0160)
(AD-A161401; ARO-19757.33-CH) Avail: NTIS HC A03/MF A01 CSCL 07/4

Currently, there is extensive interest in factors governing the size distribution and morphology of small particles produced in smokes and missile exhausts, the formation and properties of atmospheric clusters which lead to a number of phenomena such as fogs and hazes, and the generation of species that may influence the propagation of electromagnetic radiation. This research program constituted an investigation of the properties and formation of small molecule clusters which serve as prenucleation embryos to aerosol formation. Results are reported on studies of: (1) mechanisms of growth and nucleation of clusters, (2) spectroscopic properties of clusters, and (3) energetics of ion-molecule complex formation. Author (GRA)

N86-21639# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
CHARACTERIZATION OF VESICLE AND MICROEMULSION MICROSTRUCTURES Final Report, 1 Aug. 1984 - 31 Jul. 1985
D. F. Evans 31 Jul. 1985 13 p
(Contract DAAG29-84-K-0152)
(AD-A161459; ARO-21635.2-CH) Avail: NTIS HC A02/MF A01 CSCL 07/4

This research is concerned with developing strategies for controlling the structure and stability of surfactant microstructures. These structures include micelles, vesicles, microtubules, bilayers and with added oil a range of bicontinuous materials and they play key roles in many biological and industrial processes. During the past year we have characterized an unusual micelle-vesicle equilibrium, demonstrating how the structures of bicontinuous microemulsions can be controlled by mixture of oil or surfactant and by the addition of cosurfactants. In addition we have assembled a video enhanced contrast differential interference microscope which permits direct visualization of surfactant microstructures. GRA

N86-21640# Wien Univ. (Austria). Inst. fuer Physikalische Chemie.
BORONNITRIDE AND SILICONNITRIDE SYSTEMS Annual Report, Sep. 1984 - Sep. 1985
Peter Rogl and Julius Schuster Sep. 1985 152 p
(Contract DAJA45-84-C-0038)
(AD-A161563; AR-1) Avail: NTIS HC A08/MF A01 CSCL 07/4

Transition Metal-Boron-Nitrogen Systems: The existing literature data regarding the systems Fe-B-N, Co-B-N and Ni-B-N were critically assessed including the binary boundary systems. The thermodynamic phase equilibria at 900 C were reinvestigated for the binary systems Fe-B, Co-B and Ni-B using different methods of preparation and analysis. A complete constitutional diagram Fe-B was established in the temperature range 600 < T < 1700 C using X-ray phase analysis, metallography, Differential Thermal Analysis, (DTA) and melting point analysis. Transition Metal-Silicon-Nitrogen Systems: The compilation and critical assessment of existing literature data as well as the experimental investigation in the ternary systems Ti-Si-N, Zr-Si-N, V-Si-N, Nb-Si-N and Ta-Si-N and the respective TM-N as well as TM-Si binary systems were completed. Silicon nitride reacts with each of these transition metals to form either binary silicides and nitrides or ternary phases of D8 sub 8-type structure with the general formula TM5Si3N1-x. These phases are commonly known as Nowotny phases and were described in the literature. No new ternary phase was observed. GRA

N86-21641# Case Western Reserve Univ., Cleveland, Ohio.
SPECTROSCOPIC AND ELECTROCHEMICAL STUDIES OF TRANSITION-METAL TETRASULFONATED PHTHALOCYANINES. PART 6: THE ADSORPTION OF IRON TETRASULFONATED PHTHALOCYANINE ON SINGLE CRYSTAL SILVER ELECTRODES
R. Adzic, B. Simic-Glavaski, and E. B. Yeager 1 Nov. 1985 20 p
(Contract N00014-83-K-0343)
(AD-A161640; TR-58) Avail: NTIS HC A02/MF A01 CSCL 07/4

Adsorbed layers of iron tetrasulfonated phthalocyanine have been examined using cyclic voltammetry on the silver single crystal low index surface: (100), (110), and (111). The peak potentials and charge under the voltammetry peaks show some dependence on the crystal planes. The effects of the underpotential deposition of lead on the adsorbed macrocycle have also been examined on the silver single crystal electrode. The lead can be underpotential deposited on the silver directly through a pre-adsorbed macrocycle layer without desorbing the macrocycle. The data are explained in terms of a model for the adsorbed macrocycle which has the plane of the ligand perpendicular to the electrode surface. GRA

N86-21642# Indiana Univ., Bloomington. Dept. of Chemistry.
MICROVOLTAMMETRIC ELECTRODES Final Report, 1 Jul. 1982 - 30 Jun. 1985
E. M. Wrightman 25 Sep. 1985 8 p
(Contract MIPR-105-84)
(AD-A161653; ARO-18983.15-CH) Avail: NTIS HC A02/MF A01 CSCL 07/4

Microvoltammetric electrodes, electrodes of micrometer dimensions, have opened many new domains for electrical investigations. These include increased temporal resolution, increased current density, and decreased sensitivity to the effects of solution resistance. Dramatic improvements in electrochemical data can be obtained with these electrodes. A number of different areas have been investigated with the emphasis on obtaining data that is inaccessible with electrodes of conventional size. Successfully completed projects include measurement of transient electrogenerated intermediates on a microsecond time scale, the use of electrochemistry in highly resistive media such as solutions of benzene, and a characterization of the mass transport processes operant at these electrodes. In addition, the analytical opportunities of microvoltammetric electrodes have been explored, especially as liquid chromatographic detectors. GRA

N86-21643# York Univ., Downsview (Ontario). Dept. of Chemistry.
BINUCLEAR PHTHALOCYANINES AS MODEL ELECTROCATALYSTS FOR THE REDUCTION OF OXYGEN
M. Hempstead, M. Melnik, A. Nevin, W. Liu, and A. B. P. Lever May 1985 11 p
(Contract N00014-84-G-0201)
(AD-A161758; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

Binuclear cobalt phthalocyanines linked by bridges containing 1, 2, 4, or 5 atoms are shown to reduce oxygen catalytically, more efficiently than mononuclear cobalt phthalocyanines. The kinetic efficiency for oxygen reduction is related to the degree of electronic coupling between the two halves of the molecule. The Co(II) species disproportionate in non-coordinating solvents, in the presence of hydroxide ion, forming the potentially two-electron redox reagents Co(I) and Co(III)Pc. Author (GRA)

N86-21644# International Society of Electrochemistry, Lausanne (Switzerland).
EXTENDED ABSTRACTS, 36TH INTERNATIONAL SOCIETY OF ELECTROCHEMISTRY HELD AT SALAMANCA, SPAIN ON 23-28 SEPTEMBER 1985
28 Sep. 1985 98 p Meeting held in Salamanca, Spain, 23-28 Sep. 1985
(AD-A162434) Avail: NTIS HC A05/MF A03 CSCL 07/4

This document contains abstracts of articles presented at a meeting of the International Society of Electrochemistry. The articles are written on such areas as: Corrosion; Organic Electrochemistry; Electrochemical Kinetics; Bioelectrochemistry; Electroanalysis; and Electrochemical Thermodynamics. GRA

N86-21645# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
RATE COEFFICIENTS FOR THE OXIDATION REACTIONS OF ZIRCONIUM IONS WITH OXYGEN, NITRIC OXIDE, AND CARBON DIOXIDE
S. Dheandhanoo, B. K. Chatterjee, and R. Johnsen 1 Oct. 1985 4 p Document previously announced in IAAA as A86-10061
(Contract F19628-83-K-0037)
(AD-A162694; AFGL-TR-85-0308) Avail: NTIS HC A02/MF A01 CSCL 07/4

Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide have been determined in the near-thermal energy range (0.04 to about 0.4 eV) using a selected-ion drift apparatus. The reactions are found to proceed with large rate coefficient (approximately 5 to the 10th power cu cm/s at 300K). At elevated ion energies the reactions with NO and CO2 exhibit smaller rates. The secondary oxidation reactions of ZrO+ ions with the same reactants have rate coefficients about two orders of magnitude smaller than those for the first oxidation steps. The discharge ion source used to produce the zirconium ions in these experiments is described in some detail. GRA

N86-21646# San Diego State Univ., Calif. Dept. of Electrical and Computer Engineering.
ELECTRON PRODUCTION, ELECTRON ATTACHMENT, AND CHARGE RECOMBINATION PROCESS IN HIGH PRESSURE GAS DISCHARGES Annual Scientific Report, 1 Aug. 1984 - 31 Jul. 1985
Long C. Lee 10 Sep. 1985 32 p
(Grant AF-AFOSR-0314-82)
(AD-A162747; AFOSR-85-1132TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The electron productions from two-photon-ionization of CS2, SO2 and (CH3)3N at 193 nm were investigated and their coefficients were measured. The effect of space charge on the electron conduction pulse was observed as a function of charge density and the applied electric field. The electron attachment rate constants of H2O and C3F8 in buffer gases of Ar, N2, and CH4 were measured. The electron attachment rate constants for the gas mixtures of H2O-Ar, C3F8-N2 and X3F8-CH4 increase with increasing E/N. These characteristics are useful for the application of opening switches. The electron drift velocities of various gas mixtures were measured. GRA

N86-21647# Department of the Army, Washington, D. C.
ELECTROLYTE FOR LITHIUM-INORGANIC NON-AQUEOUS RECHARGEABLE CELL SYSTEM AND RECHARGEABLE CELL SYSTEM INCLUDING SAID ELECTROLYTE Patent Application
Robert J. Mammone and Michael Binder, inventors (to Army) Filed 12 Nov. 1985 13 p
(AD-D011976; US-Patent-Appl-SN-796332) Avail: NTIS HC A02/MF A01 CSCL 07/4

The general object of this invention is to provide an improved high energy lithium inorganic non-aqueous rechargeable cell system. A more particular object of the invention is to provide such an improved system wherein the lithium dithionite discharge product can be chemically oxidized so that the carbon cathode capacity is increased. The aforementioned objects can be attained by using a liquid electrolyte comprising sulfur dioxide complexed at room temperature with a salt that dissolves in sulfur dioxide without the assistance of organic co-solvents and with soluble molecular chlorine added to the complex to saturate the electrolyte. The present invention provides an improved lithium-inorganic non-aqueous rechargeable cell system having an electrolyte based on sulfur dioxide and containing dissolved molecular chlorine. The cell includes an alkali metal anode, an inorganic conductive electrolyte composed of either a metal, a metal chloride, an electroactive polymer, a carbonaceous material, a blend of carbonaceous materials, or a blend of carbonaceous materials

and various metals, metallic compounds or electroactive polymers. One of the preferred salts that can dissolve in sulfur dioxide without the assistance of organic co-solvents is LiAlCl4. GRA

N86-21648*# National Bureau of Standards, Gaithersburg, Md.
NBS (NATIONAL BUREAU OF STANDARDS): MATERIALS MEASUREMENTS Annual Report, 1 Apr. 1984 - 31 Mar. 1985
J. R. Manning Jul. 1985 98 p refs
(NASA Order H-27954-B)
(NASA-CR-176646; NAS 1.26:176646; PB86-103470; NBSIR-85-3217) Avail: NTIS HC A05/MF A01 CSCL 07D

NBS work for NASA in support of NASA's Microgravity Science and Applications Program under NASA Government Order H-2-7954B (Properties of Electronic Materials) covering the period April 1, 1984 to March 31, 1985 is described. The work has been carried out in three independent tasks: Task 1--Surface Tensions and Their Variations with Temperature and Impurities; Task 2--Convention during Unidirectional Solidification; Task 3--Measurement of High Temperature Thermodynamic Properties. The results for each task are given separately in the body of the report. GRA

N86-21649# National Bureau of Standards, Gaithersburg, Md. Center for Analytical Chemistry.
HANDBOOK FOR SRM (STANDARD REFERENCE MATERIALS) USERS Final Report
J. K. Taylor Sep. 1985 101 p refs
(PB86-110897; NBS-SP-160-100; LC-85-600576) Avail: NTIS HC A06/MF A01; Also avail: SOD as SN003-003-02689-1 CSCL 07D

The handbook was prepared to provide guidance for the use of Standard Reference Materials (SRM's) to provide an accuracy base for chemical measurements. The general concepts of precision and accuracy are discussed and their realization by quality assurance of the measurement process. General characteristics of SRM's are described and guidance is given for their selection for specific applications. Ways to effectively use SRM's are recommended, utilizing control charts to evaluate and monitor measurement accuracy. Appendices provide statistical guidance on the evaluation of measurement uncertainty. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-21650 Northwestern Univ., Evanston, Ill.
DEVELOPMENT OF AN ELEVATED TEMPERATURE ALUMINUM ALLOY CONTAINING Al3X-TYPE DISPERSED PHASES Ph.D. Thesis
Michael S. Zedalis 1985 267 p
Avail: Univ. Microfilms Order No. DA8523611

The use of high strength Al alloys for numerous aerospace applications has been severely restricted by poor elevated temperature performance. Suitable dispersed phases in high temperature Al alloys should be thermodynamically stable and exhibit partial coherency with the matrix at temperatures of interest. Minimum lattice disregistry across the precipitate/matrix boundary yields a low interfacial energy and thus, a low driving force for Ostwald ripening. The extents of solid solubility in the equilibrium, tetragonal Al3X-type dispersed phases (X represents binary and ternary combinations of Hf, Ti, V and Zr) were examined using powder X-ray diffraction methods. Minimum lattice disregistry (delta) with the Al(ss) matrix was achieved by maximizing the amount of Ti or V added to the Al3Hf and/or Al3Zr phases without forming a co-intermetallic compound exhibiting a DO sub 22 crystall structure. In comparison to Al3Zr, with a (delta) equal to 2.88%, the addition of V to Al3Zr in the ratio 7:1, results in a decrease in (delta) by approximately 17%. Dissert. Abstr.

N86-21651 Stanford Univ., Calif.
CRACK INITIATION AND MICROSTRUCTURE IN TUNGSTEN CARBIDE-COBALT COMPOSITES Ph.D. Thesis
Vikram Jayaram 1985 149 p
Avail: Univ. Microfilms Order No. DA8522164

The present work examines the consequences of a combination of slip systems for polycrystalline deformation in sintered tungsten carbide-cobalt. Also studied are microstructural features associated with thin intergranular cobalt films and a chemical reaction that follows the annealing of deformed material. Commercially sintered compositions were deformed by Vickers indentation and by compression with a superimposed constrained pressure. Slices from these samples were thinned and examined in the transmission electron microscope. Plastic incompatibility between randomly oriented grains leads to the development of stresses that promote fracture on the basal plane. Two cases of strain discontinuity are considered: those in the plane of, and those normal to the boundary between two grains. It is shown that the former can lead to intergranular cracking from a triple point and transgranular failure. Experimental observations of cracks and uncracked boundaries confirm the validity of a crystallographic analysis of incompatible deformation. The implications for fracture initiation in other brittle materials are considered. Dissert. Abstr.

N86-21652 Virginia Univ., Charlottesville.
RAPIDLY SOLIDIFIED ALLOYS OF IRON-RARE EARTH BORON FOR PERMANENT MAGNETS Ph.D. Thesis
Ruel Anthony Overfelt 1984 158 p
Avail: Univ. Microfilms Order No. DA8522485

The effects of composition and processing variables on the magnetic properties of rapidly solidified iron-rare earth-boron alloys have been explored using a vibrating sample magnetometer. Additionally, supporting microstructural analyses are given to help explain the observed variations. This work has concentrated on producing large intrinsic coercivities, i.e., greater than about 10 kOe, directly at controlled solidification rates in melt spinning. Intrinsic coercivities of only 100 to 1000 Oe are obtained at the lowest (0 to 4 m/s) and highest (40 to 80 m/s) wheel surface speeds in all alloys investigated. Intrinsic coercivities over 20 kOe have been obtained at intermediate wheel surface speeds (20 to 30 m/s) in alloys of Fe sub 76 R sub 76 B sub 76 where substituting samarium and cerium for praseodymium and neodymium does not lead to large intrinsic coercivities at all wheel surface speeds. Replacements of boron with the metalloids carbon or silicon are also ineffective in producing large intrinsic coercivities.
Dissert. Abstr.

N86-21653 Notre Dame Univ., Ind.
A STUDY OF SUBSURFACE MICROSTRUCTURAL CHANGES DUE TO ABRASION OF ALUMINUM, COPPER AND NICKEL Ph.D. Thesis
C. Mukund Rao 1986 190 p
Avail: Univ. Microfilms Order No. DA8523612

The subsurface dislocation structures and the extent of dynamic recovery and recrystallization in pure metals subjected to low-stress abrasion have been examined. Pure aluminum, copper and nickel were chosen to provide a range of recrystallization temperature and thermal conductivities. Large grain specimens were abraded on a dry sand rubber wheel abrasion tested (RWAT) using three different abrasives: -50 + 70 mesh-rounded quartz, -50 + 70 crushed quartz and 80 grit Al2O3. X-ray diffraction-back-reflection pinhole patterns of the original specimens gave single-crystal Laue patterns, whereas the abraded specimens produced Debye rings. In the case of aluminum the Debye rings showed distinct individual spots, whereas the copper and nickel produced smooth, continuous rings. Patterns from aluminum samples abraded with semi-rounded quartz showed fewer spots on the Debye rings than with the other two abrasives. There was no effect of the differences between abrasives for copper and nickel.
Dissert. Abstr.

N86-21654*# Syracuse Univ., N. Y.
GRAIN BOUNDARY OXIDATION AND AN ANALYSIS OF THE EFFECTS OF PRE-OXIDATION ON SUBSEQUENT FATIGUE LIFE

Yoshiki Oshida and H. W. Liu Feb. 1986 38 p refs
(NASA-CR-175051; NAS 1.26:175051) Avail: NTIS HC A03/MF A01 CSCL 11F

The effects of preoxidation on subsequent fatigue life were studied. Surface oxidation and grain boundary oxidation of a nickel-base superalloy (TAZ-8A) were studied at 600 to 1000 C for 10 to 1000 hours in air. Surface oxides were identified and the kinetics of surface oxidation was discussed. Grain boundary oxide penetration and morphology were studied. Pancake type grain boundary oxide penetrates deeper and its size is larger, therefore, it is more detrimental to fatigue life than cone-type grain boundary oxide. Oxide penetration depth, a (sub m), is related to oxidation temperature, T, and exposure time, t, by an empirical relation of the Arrhenius type. Effects of T and t on statistical variation of a (sub m) were analyzed according to the Weibull distribution function. Once the oxide is cracked, it serves as a fatigue crack nucleus. Statistical variation of the remaining fatigue life, after the formation of an oxide crack of a critical length, is related directly to the statistical variation of grain boundary oxide penetration depth. Author

N86-21655*# National Aeronautics and Space Administration, Washington, D.C.

DIFFUSION AND SOLUBILITY OF OXYGEN IN SILVER

W. Eichenauer and G. Miller Nov. 1985 12 p refs Transl. into ENGLISH from Diffusion and Loeslichkeit von Sauerstoff in Silber (Stuttgart, West Germany), v. 53, 1962 p 321-324 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. was prep. by Technical Univ., Darmstadt, West Germany
(Contract NASw-4005)
(NASA-TM-77938; NAS 1.15:77938) Avail: NTIS HC A02/MF A01 CSCL 11F

The diffusion and solubility of oxygen in Ag in the temperature range between 412 and 862 C was determined. The following interpolation formula was found for the solubility: L = 8.19.1/100. exp(-11 860/RT)Mol O2/g.At.Ag.at 1/.5. The process obeys the Sieverts square root law within the limits of error. The dissolution of oxygen in Ag may be accompanied by the dissociation of the oxygen molecules into atoms. The tests on Ag-foils reveal that below a temperature of about 500 C a higher solubility is simulated by the adsorption of oxygen. The diffusion coefficient of oxygen in silver obeys the following equation: D = 2.72.1/100.exp(-11 000/RT)sq cm/s. The relatively low activation energy of 11 kcal/g.At suggests that the diffusion of oxygen takes places over interstitial sites. E.A.K.

N86-21656*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.

EFFECT OF BORON ON TENSILE PROPERTIES OF B2 BeAl Final Report

M. Crimp and K. Vedula Feb. 1986 17 p refs
(Grant NAG3-563; Contract DE-AI-01-77CS-51040)
(NASA-CR-175074; DOE/NASA/0563-1; NAS 1.26:175074) Avail: NTIS HC A02/MF A01 CSCL 11F

Small additions of boron were shown to improve the room temperature ductility of the intermetallic compound Ni3Al. Boron is believed to segregate to the gain boundaries and strengthen them, allowing the inheret ductility of the grains to be achieved. The present study was undertaken to see if boron has a similar effect on the low temperature tensile properties of the equiatomic intermetallic compound FeAl. A binary alloy without boron is compared with an alloy containing 0.78 at % B (0.2 wt %) B, by tensile testing over the temperature range of 300 K to 640 K. Both alloys were processed by powder metallurgy. Results showed that 0.78 at % B addition to FeAl does indeed change the room temperature fracture mode from intergranular to transgranular, suggesting a strengthening of grain boundaries. The alloy containing boron is, however, still brittle at room temperature. A slight decrease in the ductile to brittle transition temperature is, nevertheless, observed. In addition a significant increase in strength of the alloy is observed with boron addition. Author

N86-21657*# National Aeronautics and Space Administration, Washington, D.C.

EFFECT OF ADDITIONAL HEAT TREATMENT OF 2024-T3 ON THE GROWTH OF FATIGUE CRACK IN AIR AND IN VACUUM

E. P. Louwaard Feb. 1986 19 p refs Transl. into ENGLISH of "Invloed van het Naveredelen van 2024-T3 op het Groeien van Vermoeilingsscheueren in Lucht en in Vacuum" rept. LR-237 Delft Technical Univ., Delft, Netherlands, 1976 p 1-16 Original language document was announced as N78-15255 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77984; NAS 1.15:77984) Avail: NTIS HC A02/MF A01 CSCL 11F

In order to determine the influence of ductility on the fatigue crack growth rate of aluminum alloys, fatigue tests were carried out on central notched specimens of 2024-T3 and 2024-T8 sheet material. The 2024-T8 material was obtained by an additional heat treatment applied on 2024-T3 (18 hours at 192 C), which increased the static yield strength from 43.6 to 48.9 kgf/sq mm. A change in the ultimate strength was not observed. Fatigue tests were carried out on both materials in humid air and in high vacuum. According to a new crack propagation model, crack extension is supported to be caused by a slip-related process and debonding triggered by the environment. This model predicts an effect of the ductility on the crack growth rate which should be smaller in vacuum than in humid air; however, this was not confirmed. In humid air the crack-growth rate in 2024-T8 was about 2 times faster than in 2024-T3, while in vacuum the ratio was about 2.5. Crack closure measurements gave no indications that crack closure played a significant role in both materials. Some speculative explanations are briefly discussed. Author (ESA)

N86-21658*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ROLE OF MOLYBDENUM IN THE Na SUB 2SO SUB 4 INDUCED CORROSION OF SUPERALLOYS AT HIGH TEMPERATURES

A. K. Misra (Case Western Research Univ., Cleveland, Ohio) [1986] 29 p refs Presented at the TMS-AIME Annual Meeting, New Orleans, La., 2-6 Mar. 1986
(NASA-TM-87235; E-2905; NAS 1.15:87235) Avail: NTIS HC A03/MF A01 CSCL 11F

Sodium sulfate induced corrosion of a molybdenum containing nickel-base superalloy, Udimet 700, was studied in laboratory furnace tests and in a high velocity (Mach 0.3) burner rig. The effect of SO2 content in the atmosphere on the corrosion behavior in the laboratory furnace tests was determined. Catastrophic corrosion occurs only when the melt contains MoO3 in addition to Na2SO4 and Na2MoO4. The conditions under which catastrophic corrosion occurs are identified and a mechanism is described to explain the catastrophic corrosion. Author

N86-21659*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

UNDERCOOLED AND RAPIDLY QUENCHED Ni-Mo ALLOYS

S. N. Tewari and T. K. Glasgow (Defence Metallurgical Research Lab., Hyderabad, India) [1986] 19 p refs Presented at the Hume Rothery Memorial Symposium on Undercooled Alloy Phases at the AIME Annual Meeting, New Orleans, La., 2-6 Mar. 1986 Sponsored in part by National Research Council
(NASA-TM-87257; E-2947; NAS 1.15:87257) Avail: NTIS HC A02/MF A01 CSCL 11F

Hypoeutectic, eutectic, and hypereutectic nickel-molybdenum alloys were rapidly solidified by both bulk undercooling and melt spinning techniques. Alloys were undercooled in both electromagnetic levitation and differential thermal analysis equipment. The rate of recalescence depended upon the degree of initial undercooling and the nature (faceted or nonfaceted) of the primary nucleating phase. Alloy melts were observed to undercool more in the presence of primary Beta (NiMo intermetallic) phase than in gamma (fcc solid solution) phase. Melt spinning resulted in an extension of molybdenum solid solubility in gamma nickel, from 28 to 37.5 at % Mo. Although the microstructures observed by undercooling and melt spinning were similar the microsegregation pattern across

the gamma dendries was different. The range of microstructures evolved was analyzed in terms of the nature of the primary phase to nucleate, its subsequent dendritic growth, coarsening and fragmentation, and final solidification of interfenderitic liquid.
Author

N86-21660*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF A STANDARD TEST METHOD FOR TOTAL HEMISPHERICAL EMITTANCE OF SURFACES FROM 293K TO 1673K
E. Conrad Compton Jan. 1986 22 p refs
(NASA-TM-87681; NAS 1.15:87681) Avail: NTIS HC A02/MF A01 CSCL 11F

Emittance tests were made on samples of Rene' 41, Haynes 188, and Inconel 625 superalloy metals in an evaluation of a standard test method for determining total hemispherical emittances of surfaces from 293 K to 1673 K. The intent of this evaluation was to address any problems encountered, check repeatability of measured emittances, and gain experience in use of the test procedure. Five test specimens were fabricated to prescribe test dimensions and surfaces cleaned of oil and residue. Three of these specimens were without oxidized surfaces and two with oxidized surfaces. The oxidized specimens were Rene' 41 and Haynes 188. The tests were conducted in a vacuum where the samples were resistance-heated to various temperature levels ranging from 503 K to 1293 K. The calculated results for emittance, in the worst case, were repeatable to a maximum spread to + or - 4% from the mean of five sets of plotted data for each specimen.
Author

N86-21661*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VARIABLES CONTROLLING FATIGUE CRACK GROWTH OF SHORT CRACKS
Jack Telesman, Douglas M. Fisher, and Donna Holka (Michigan Technological Univ., Houghton) Dec. 1985 20 p refs Presented at the International Conference on Fatigue, Corrosion Cracking, Fracture Mechanics, and Failure Analysis, Salt Lake City, Utah, 2-6 Dec. 1985; sponsored by American Society for Metals
(NASA-TM-87208; E-2865; NAS 1.15:87208) Avail: NTIS HC A02/MF A01 CSCL 11F

A study was conducted to evaluate the roles of crack closure and microstructure in the fatigue growth of short cracks. Testing was performed at R ratios of 0.1, 0.5, and 0.7. At all R ratios short cracks exhibited accelerated growth rates in comparison to long cracks. It was concluded that crack closure could not entirely account for the accelerated growth rates of short cracks. The accelerated growth rates occurred over crack lengths on the order of grain size, suggesting a strong influence of microstructure. A significant effect of grain boundaries and inclusions on short crack FCG behavior was observed. For very short crack lengths, fatigue growth rates do not appear to be a function of either delta K or R ratio.
Author

N86-21662# Fairchild Republic Co., Farmingdale, N.Y.
STRUCTURAL EVALUATION OF SUPERPLASTIC ALUMINUM. PART 1. MECHANICAL, CORROSION, METALLURGICAL DATA Final Report, Jun. 1983 - Mar. 1985
Hadassah C. Lipsius, Julius Stock, and Alvin Shames Aug. 1985 120 p
(Contract F33615-83-C-3208)
(AD-A161366; AFWAL-TR-85-3050-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 11/6

The mechanical, corrosion, metallurgical and secondary fabricability properties of the superplasticity formable Supral alloy were evaluated to assess the amenability of these alloys to standard aircraft practices. Fracture and fatigue properties were evaluated through extensive testing of superplasticity formed parts and discs. The mechanical property test results meet Alcan/Superform claims provided that the microaviation is restricted to less than three percent of the volume. Research findings show that Supral 100, 150, and 220 are alloys suitable for aircraft use. Testing of shop manufacturing practices and welding techniques indicate that the Supral alloys are comparable to standard U.S. aluminum alloys.
GRA

N86-21663# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
AGE HARDENING OF BINARY IRON-NICKEL MARTENSITES Final Report, 6 Feb. 1981 - 31 May 1985
J. T. Carter, Zhang Guosheng, and W. C. Leslie Jul. 1985 109 p
(Contract DAAG29-81-K-0052)
(AD-A161407; ARO-17752.3-MS) Avail: NTIS HC A06/MF A01 CSCL 11/6

Age hardening of binary Fe-Ni martensites was investigated to determine the nature and kinetics of the hardening reaction. Six Fe-Ni alloys containing 24 to 34 wt% Ni were austenitized, quenched, then cooled to either 16 degrees C to retain austenite or to -196 degrees C to promote the transformation to martensite. Specimens were aged at six temperatures between 270 and 450 degrees C for up to 14,000 hr. Four other ferritic/martensitic alloys containing 5 to 30 wt% Ni, previously cold rolled and aged 8000 hr, were also aged. Specimens were studied by hardness and tensile testing, X-ray diffraction, electron microscopy, and Fe-57 Mossbauer spectroscopy. Age hardening occurred in all of the 24 to 34 wt% Ni martensites and at all of the aging temperatures. The maximum hardening of 270 HV (up to 480 HV) occurred in an Fe-32Ni martensite upon aging 8000 hr at 300 C. Hardening was attributed to Ni-rich, disc-shaped, austenite particles formed on (110) matrix planes during aging. The 30 to 34 wt% Ni alloys cooled to 16 C were largely austenite, very soft (100 HV), and not age harden.
GRA

N86-21664# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
A STUDY OF PRECIPITATION AND SEGREGATION ON AN ATOMIC SCALE OF 11AT.PERCENTCr-LAT.PERCENTMo HEAT RESISTING STEEL BY ATOM-PROBE AND TEM (TRANSMISSION ELECTRON MICROSCOPE)
N. Igata, S. Sato, T. Ando, T. Hashizume, and T. Sakurai Nov. 1985 11 p
(Contract N00014-84-K-0201)
(AD-A161590) Avail: NTIS HC A02/MF A01 CSCL 11/6

An 11at.%Cr-lat%Mo commercial steel which contains C, Si, Mn, Nb and V as minor elements was investigated by atom-probe (AP) and transmission electron microscopy (TEM). This steel has an excellent heat resisting property at 600 - 650 C but undergoes the ductile - brittle transition in this temperature range. The following results were obtained: (1) After solution treatment the FIM image was homogenous on an atomic scale. (2) After tempering at 650 C for 1 hr a precipitate was detected. AP analysis showed that the precipitate was M(C+N) where M is Nb, Cr, V, Mo and Fe. (3) After tempering at 700 C for 1 hr, a precipitate with a Fe/Cr ratio of 60/40 (sigma phase) was also observed at the lath boundary, and adjacent to this region the chromium concentration decreased to 1%.
GRA

N86-21665# California Univ., Berkeley. Dept. of Mechanical Engineering.
TWO-DIMENSIONAL STRAIN CYCLING IN PLASTICITY
P. M. Naghdi and D. J. Nikkel, Jr. Nov. 1985 65 p
(Contract N00014-84-K-0264)
(AD-A161666; UCB/AM-85-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

Detailed calculations are presented for strain cycling in a homogenous deformation that can be sustained by a biaxial state of stress in thin-walled specimens of OFHC copper. These calculations are made with a set of relatively simple constitutive equations within the framework of the strain-space formulation of plasticity. The predicted theoretical calculations, carried out in the context of small deformation, are in good agreement with corresponding available experimental results for saturation hardening and erasure of memory in two-dimensional strain cycling. Also, with the use of the calculated results, a scalar quantity that

characterizes strain-hardening is plotted as a function of plastic strains. Such plots are likely to be useful for computational purposes. Author (GRA)

N86-21666# National Bureau of Standards, Gaithersburg, Md. Metallurgy Div.
MECHANISMS AND KINETICS OF SURFACE ALLOYING BY DIFFUSION-INDUCED GRAIN BOUNDARY MIGRATION Final Report, 1 Apr. 1982 - 30 Apr. 1985
J. R. Manning, J. W. Cahn, D. B. Butrymowicz, and C. A. Handwerker Sep. 1985 43 p
(Contracts MIPR-ARO-42-82; MIPR-ARO-163-83)
(AD-A161671; ARO-19262.5-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

The phenomenon of diffusion-induced grain boundary migration has been investigated to determine conditions under which this effect occurs and to establish the mechanism and driving forces that control the process. This migration and the surface alloying that accompanies it were observed in a number of different alloy systems, including Cu-Zn, Cu-As, Au-Pd, Fe-Zn, Fe-Cr, and Fe-As. Detailed tests in the Ag-Au alloy system using thin layers of diffusant deposited on a metal substrate and analyses of liquid phase sintering experiments in Mo-Ni base alloys indicated that the driving force for diffusion-induced grain boundary migration depends on lattice parameter variations in the alloy. Connections were made between diffusion-induced grain boundary migration in solid alloy systems and liquid film migrations that occur during liquid phase sintering. The theory then was used to select ceramic systems in which migrations might occur and as a result diffusion-induced liquid film migration was observed for the first time in a ceramic system. Author (GRA)

N86-21667# Virginia Univ., Charlottesville. Dept. of Materials Science.
MODIFICATIONS IN MICROSTRUCTURE, DEFORMATION AND FATIGUE BEHAVIOR BY ION IMPLANTATION Final Report, 1 Mar. 1983 - 31 May 1985
K. V. Jata and E. A. Starke, Jr. Oct. 1985 21 p
(Contract N00014-83-K-0263)
(AD-A161688; UVA/525386/MS86/101) Avail: NTIS HC A02/MF A01 CSCL 11/6

A number of materials, copper, aluminum, titanium and steel, have been examined for microstructural evolution, deformation and fatigue behavior in the ion implanted, as - implanted and implanted + annealed conditions. A wide variety of implant species that produce residual compressive stresses, residual tensile stresses or cause precipitation have been chosen to examine the above effects. The main goal has, however, been to choose implant species that would enhance deformation and fatigue resistance through a modification in the surface microstructure and/or by providing residual compressive stresses. In instances where no major changes in the surface microstructure are observed it appears that surface dislocation sources either become inoperative or become operative on a larger number of slip planes, limiting the size of the slip steps that would nucleate fracture. In materials where major changes in the microstructure are observed, slip is dispersed, also resulting in fine slip that enhances resistance. Ion implantation is being used to modify surface-related mechanical properties such as friction and wear, fatigue, corrosion and recently, near surface deformation at high temperatures. GRA

N86-21668# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
VOID INITIATION PRECEDING DUCTILE FRACTURE IN POLYCRYSTALLINE TITANIUM
Heinz G. F. Wilsdorf and Marjorie A. Erickson Sep. 1985 31 p
(Contract N00014-82-K-0309)
(AD-A161821; AD-E900526; UVA/525375/MS86/101) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this research was determination of primary void initiation sites preceding void growth in the process of deformation leading to ductile fracture in polycrystalline C.P. titanium. Stereo-photogrammetry was employed to evaluate SEM fracture surfaces. Two distinct regimes of void initiation were found to operate in: (1) specimens with grain sizes up to 50 micron void initiation occurring predominately at grain boundary triple points; and (2) larger grain sized material. Here, additional void sites were due to twinning and glide band intersections and grain boundaries and grain boundary ledges themselves. Quantitative topographical information was the basis for constructing fracture surface profiles which permitted the determination of time sequence of void initiation. GRA

N86-21669# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE 3RD NATIONAL CONFERENCE ON METALLIC POWDER STUDY WAS HELD IN AN-SHAN
Gau Ping 21 Nov. 1985 5 p Transl. into ENGLISH from Gangtie (China), no. 2, 1983 p 76-77 Conference held in An-Shan, China, 13-17 Oct. 1982
(AD-A162408; FTD-ID(RS)T-0928-85) Avail: NTIS HC A02/MF A01 CSCL 11/6

The Chinese Society of Metallic Science held its Third National Conference on Metallic Powder in An-Shan, Liaoning, between October 13 and 17, 1982. Participants of this meeting came from 25 provinces, cities, autonomous areas, all related ministries and scientific institutes. A total of 139 experts, scholars and engineering-technical personnel from 81 different units in research and development, manufacturing and design areas took part in the conference. The results of this Conference is discussed. GRA

N86-21670# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
CORROSION FATIGUE OF Al-Zn-Mg AND Al-Mg-Li ALLOYS Final Technical Report
R. E. Ricker and D. J. Duquette Jan. 1986 276 p Prepared in cooperation with Notre Dame Univ., Ind.
(Contract N00014-67-A-0117-0012)
(AD-A162627) Avail: NTIS HC A13/MF A01 CSCL 11/6

Corrosion fatigue and related electrochemical experiments have been conducted on a high purity Al-Zn-Mg ternary alloy and a high purity Al-Mg-Li ternary alloy. The electrochemical experiments were performed in solutions of various concentrations of sodium chloride and sodium sulfate as functions of pH, temperature and degree of aeration. Thin sheets of the alloys were examined in strain controlled fatigue with controlled environmental conditions. Samples were heat treated to obtain the maximum tensile strength, electropolished, and stored in vacuum to remove absorbed hydrogen. Fatigue tests were performed in dry nitrogen gas as a reference environment, and compared with tests in humid nitrogen, distilled water, 0.5 molar sodium sulfate and 0.5 molar sodium chloride. The corrosion test results indicate that the corrosion potentials of the Al-Mg-Li alloy are considerably more active than those of the Al-Zn-Mg alloy and that the pitting potentials are slightly more active. Therefore, while the lithium alloy pits more readily at the same potential in a given environment, the overpotential or energy required to induce pitting in the lithium containing alloy is greater than that required for Al-Zn-Mg alloys. These results are consistent with the hypothesis that corrosion fatigue of these alloys in environments containing water to water vapor results from hydrogen assisted fracture. The differences in the behavior of the alloys is attributed to either reduced hydrogen absorption or to reduced susceptibility to hydrogen assisted fracture. GRA

N86-21671# Army Armament Research and Development Command, Watervliet, N. Y. Close Combat Armaments Center.
THE ELECTROPLATING OF LAMINATED CHROMIUM Final Report
E. S. Chen, G. P. Capsimalis, and G. R. Weigle Nov. 1985 24 p Presented at 12th International Conference, Metallurgical Coatings, Los Angeles, Calif., 15-19 Apr. 1985
(AD-A162751; ARCCB-TR-85002) Avail: NTIS HC A02/MF A01 CSCL 13/8

A microprocessor-controlled flow plating process was developed to deposit laminated chromium consisting of alternating

layers of low contraction (LC) and high contraction (HC) chromium. The automated plating system contains a large number of variable parameters designed to allow the use of multiple plating modes. The available modes include a combination of direct current, interrupted, periodic reverse, pulse, and laminated chromium plating. The laminated plating experiments were conducted at LC/HC solution temperatures of 85 and 55 C, current densities of 120 and 45 A/dm sq, and at LC/HC duty cycles to produce spacings between 0l01 and 2.7 micrometers. Under these plating conditions, deposits with hardness values between 655 and 1089 KHN and tensile strengths between 6.8 and 57.2 were obtained. GRA

N86-21672# Los Alamos National Lab., N. Mex.
CONTROLLED POWDER MORPHOLOGY EXPERIMENTS IN MEGABAR 304 STAINLESS STEEL COMPACTION
K. P. Staudhammer and K. A. Johnson 1985 25 p Presented at the EXPLOMET 85 International Conference on Metallurgical Applications of Shock Wave and High Strain-Rate Phenomena, Portland, Ore., 28 Jul. 1985
(Contract W-7405-eng-36)
(DE86-002416; LA-UR-85-3625; CONF-850770-13) Avail: NTIS HC A02/MF A01

Experiments with controlled morphology including shape, size, and size distribution were made on 304L stainless steel powders. These experiments involved not only the powder variables but pressure variables of 0.08 to 1.0 Mbar. Also included are measured container strain on the material ranging from 1.5% to 26%. Using a new strain controllable design it was possible to seperate and control, independently, strain and pressure. Results indicate that powder morphology, size distribution, packing density are among the pertinent parameters in predicting compaction of these powders. DOE

N86-21673# Oak Ridge National Lab., Tenn.
FINAL REPORT ON 3 Cr-1.5 Mo STEELS FOR GASIFIER PRESSURE VESSEL CONSTRUCTION Final Report
R. W. Swindeman, J. F. King, and R. K. Nanstad Sep. 1985 136 p refs
(Contract DE-AC05-84OR-21400)
(DE86-002905; ORNL/TM-9731) Avail: NTIS HC A07/MF A01

Results from an experimental program to evaluate the potential of 3 Cr-1.5 Mo steels for construction of large gasifier vessels for service at metal temperatures of 316C and pressures to 8 MPa are provided. Information starts with processing data for three commercial heats with different elements added for hardenability and strength. This is followed by a description of welding practices, which included submerged arc and shielded metal arc methods. Hardenability data are provided along with information on tempering and postweld heat treating. The mechanical properties compiled included tensile and impact strength, fracture toughness, fatigue, and embrittlement. The steels were found to be very promising and competitive with the best of the new steels being developed for petrochemical and petroleum applications. DOE

N86-21674# Oak Ridge National Lab., Tenn.
EROSION-RESISTANT TiB2 COATINGS FORMED BY CHEMICAL VAPOR DEPOSITION
A. J. Caputo, D. P. Stinton, and J. C. McLaughlin Oct. 1985 31 p refs
(Contract DE-AC05-84OR-21400)
(DE86-003003; ORNL/TM-9813) Avail: NTIS HC A03/MF A01

Erosion- and wear-resistant coatings are needed for numerous applications for coal liquefaction and gasification plants. Titanium diboride is unusually hard and stable and, in earlier work, had shown promise for use in highly erosive and corrosive environments. Our objective was to continue to study the deposition of TiB2 with emphasis on obtaining erosion-resistant coatings on various substrate materials. Coatings of TiB2 were deposited at temperatures from 800 to 1000(0)C by using TiCl4 and BCl3. Substrates used included commercial and experimental cemented carbides, nickel-bonded and hot-pressed TiB2, and abrasion-resistant grades of cast iron. The erosion resistance of the deposited coatings was determined by a hot coal-oil or silica-oil slurry impingement test. Some coatings deposited at 900 and 1000(0)C were found to be erosion resistant, although coatings could not be reproducibly deposited. Erosion-resistant coatings were deposited on the various substrates tested. Coatings deposited at 800(0)C were not erosion resistant, and their microhardness was lower than that of coatings deposited at 900 or 1000(0)C. DOE

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-21675* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ETHYNYL AND SUBSTITUTED ETHYNYL-TERMINATED POLYSULFONES Patent
Paul M. Hergenrother, inventor (to NASA) Issued 21 Jan. 1986 5 p Division of US-Patent-4,431,761; US-Patent-Appl-SN-433598, filed 8 Oct. 1982
(NASA-Case-LAR-12931-2; US-Patent-4,565,886; US-Patent-Appl-SN-527914; US-Patent-Class-556-436; US-Patent-Class-585-24; US-Patent-Class-260-544-D) Avail: US Patent and Trademark Office CSCL 06C

Ethynyl and substituted ethynyl-terminated polysulfones and their synthesis are disclosed. These polysulfones are thermally cured to induce cross-linking and chain extension, producing a polymer system with improved solvent resistance and use temperatures. Also disclosed are substituted 4-ethynylbenzoyl chlorides as precursors to the substituted ethynyl-terminated polysulfones and a process for preparing the same.
Official Gazette of the U.S. Patent and Trademark Office

N86-21676 Department of the Air Force, Washington, D.C.
THERMOSETTING ARYLETHER COMPOUNDS AND THEIR SYNTHESIS Patent
Bruce A. Reinhardt, Fred E. Arnold, and Marilyn R. Unroe, inventors (to Air Force) Issued 15 Oct. 1985 4 p Supersedes AD-D011269
(AD-D012025; US-Patent-4,547,592; US-Patent-Appl-SN-634346; US-Patent-Class-568-33) Avail: US Patent and Trademark Office CSCL 07/3

In this patent arylether compounds containing terminal phenylethynyl groups are provided. Also provided is a process for producing these compounds. The following compounds are claimed; 4,4'-bis(3-phenylethynyl-phenoxy) diphenylsulfone; 2,2-bis(((3-phenoxy)-3-phenoxy)-3-phenylethynyl)-3-phenoxy)-4phenyl)-propane and 2,2-bis((((3-phenoxy-4-phenoxy)-3-phenyl ethynyl)-3-phenoxy-4-phenyl)-hexafluoropropane. GRA

N86-21677*# National Aeronautics and Space Administration, Washington, D.C.
CONTRIBUTION TO THE PHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF BORON TRIOXIDE IN GLASSES
D. Markova Dec. 1985 9 p refs Transl. into ENGLISH from Sklar a Keramik (Czechoslovakia), v. 31, no. 7, 1981 p 193-195 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77955; NAS 1.15:77955) Avail: NTIS HC A02/MF A01 CSCL 11B

The photometric determination for boron trioxide is described in amounts of 0-75 micrograms B2O3 with an azomethin H reagent. The yellow colored complex which occurs in a medium held at a pH of 4.5 was measured in light of a wavelength of 415 nm.
Author

N86-21678*# National Aeronautics and Space Administration, Washington, D.C.
MANUFACTURE OF HIGH-DENSITY CERAMIC SINTERS
Y. Hibata Oct. 1986 10 p Transl. into ENGLISH of Japanese

Patent no. 59-116178 (4 Jul. 1984) p 1-6 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77925; NAS 1.15:77925) Avail: NTIS HC A02/MF A01 CSCL 11B

High density ceramic sinters are manufactured by coating premolded or presintered porous ceramics with a sealing material of high SiO2 porous glass or nitride glass and then sintering by hot isostatic pressing. The ceramics have excellent abrasion and corrosion resistances. Thus LC-10 (Si3N2 powder) and Y2O3-Al2O3 type sintering were mixed and molded to give a premolded porous ceramic (porosity 37%, relative bulk density 63%). The ceramic was dipped in a slurry containing high SiO2 porous glass and an alcohol solution of cellulose acetate and dried. The coated ceramic was treated in a nitrogen atmosphere and then sintered by hot isostatic pressing to give a dense ceramic sinter. Author

N86-21679*# National Aeronautics and Space Administration, Washington, D.C.
SILICON CARBIDE SINTERED PRODUCTS AND A METHOD FOR THEIR MANUFACTURING
Keiichiro Suzuki Oct. 1986 35 p Transl. into ENGLISH of German Patent no. DE3,344,263 (28 Jun. 1984) p 1-35 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77932; NAS 1.15:77932) Avail: NTIS HC A03/MF A01 CSCL 11B

SiC based sinters are produced by pressureless sintering from a SiC-AlN solid solution containing Al2 to 20, N 0.2 to 10, O 0.2 to 5, a Group IIIB element 0 to 15 percent, the remainder being Si and C. Thus, a 90:10 mixture of SiC and AlN powders were cold pressed at 2000 kg/sq cm and sintered for 5 hours at 2100 C in a nitrogen atmosphere. The resulting product had density of 3.11 g/cu cm and bending strength at ambient and 1400 C at 68.5 and 66.3 kg/sq mm. Author

N86-21680*# National Aeronautics and Space Administration, Washington, D.C.
CAPSULATION OF MOLDINGS MADE FROM SILICON CERAMIC MATERIAL
Axel Rossmann, Klaus Schweitzer, and Werner Huether Oct. 1985 8 p Transl. into ENGLISH of West Germany Patent Application No. 2737208 (18 Aug. 1977) p 1-3 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77933; NAS 1.15:77933) Avail: NTIS HC A02/MF A01 CSCL 11B

Ceramic articles are potted for hot isostatic pressing by porous glass and/or ceramic coating which is sintered to a pressure-tight coating in vacuo. Thus, a powdered SiO2 glass mixture with saturated alcohol sterin is sprayed on a Si3N4 ceramic, dried, introduced into the press which is evacuated to less than 0.013 mbar and heated to approximately 1200 C to drive off the organic binder and leave a powdered glass coating on the ceramic. The coating is sintered by heating to approximately 1200 C for 0.5 to 2 hours and forms a tight gass-impermeable layer. The press is heated to approximately 1700 C at 1000-300 bar and isostatic pressing is performed in the conventional manner. Author

N86-21681*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRON MICROSCOPIC DETERMINATION OF THE METASTABLE DISSOCIATION REGION IN THE SYSTEM LI SUB 2SIO3-SIO SUB 2
M. Marinov and M. Radenkov-Yaneva Feb. 1986 7 p refs Transl. into ENGLISH from Elektronenmikroskopische Bestimmung des Metastabilen Entmischungsgebietes im System Li2 SiO3-SiO2, Doklady Bolgarskoy Akademi Nauk, Comptes Rendue de lAcademi Bulgare des Sciences, v. 19, no. 10, 1966 p 917-920 Transl. by SCITRAN, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77980; NAS 1.15:77980) Avail: NTIS HC A02/MF A01 CSCL 11B

Seven glasses with an alkali oxide content in the range 9.57 to 29.53 mole percent were investigated. The temperature at which the transition of microheterogeneous mixing to the condition of mutual solubility occurs on heating is found. It is found that the altered constituent composition results in the alteration in the percentage amount of the coexisting phases. Author

N86-21682*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW CHROMIUM CARBIDE-BASED TRIBOLOGICAL COATING FOR USE TO 900 DEG C WITH PARTICULAR REFERENCE TO THE STIRLING ENGINE Final Report
Harold E. Sliney 1986 17 p refs Presented at the International Conference on Metallurgical Coatings, San Diego, Calif., 7-11 Apr. 1986; sponsored by the American Vacuum Society and the American Society for Metals
(Contract DE-AI01-85CE-50112)
(NASA-TM-87274; E-2977; DOE/NASA/50112-65; NAS 1.15:87274) Avail: NTIS HC A02/MF A01 CSCL 11G

A new chromium carbide-based coating (PS 200) is described. This coating is shown to have good friction and wear properties over a wide temperature range. A nickel alloy-bonded chromium carbide coating was used as a baseline material for comparison with experimental formulated coatings. Coatings were plasma sprayed onto metal disks, then diamond ground to a thickness of 0.025 cm. Friction and wear were determined using a pin on disk tribometer at temperatures from 25 to 900 C in hydrogen, helium, and air. Pin materials included several metallic alloys and silicon carbide. It was found that appropriate additions of metallic silver and of barium fluoride/calcium fluoride eutectic to the baseline carbide composition significantly reduced friction coefficients while preserving, and in some cases, even enhancing wear resistance. The results of this study demonstrate that PS 200 is a promising coating composition to consider for high temperature aerospace and advanced heat engine applications. The excellent results in hydrogen make this coating of particular interest for use in the Stirling engine. Author

N86-21683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON OF THE BROMINATION DYNAMICS OF PITCH-BASED AND VAPOR-GROWN GRAPHITE FIBERS
James R. Gaier [1986] 16 p refs Presented at the March Meeting of the American Physical Society, Las Vegas, Nev., 31 Mar. - 4 Apr. 1986
(NASA-TM-87275; E-2978; NAS 1.15:87275) Avail: NTIS HC A02/MF A01 CSCL 11G

The electrical resistance of pitch based P-100 fibers and experimental organic vapor grown fibers was recorded in-situ during bromination and subsequent exposure to ambient laboratory air. The results indicate that the bromination and debromination reactions proceed much slower for vapor grown fibers than for pitch based. While this may be due in part to the larger diameter of the vapor grown fibers, the majority of the effect can probably be attributed to the differences in graphene plane orientation between the fiber types. Although the reactions are slower in the vapor grown than in the pitch based fibers, the extent of reaction as measured by the change in electrical resistance is essentially the same, with comparable (or larger) decreases in resistivity. The bromination reaction proceeds with one or more plateaus in the resistance versus time curves, which suggests staging and strengthens the argument that these fibers produce true intercalation compounds. Author

N86-21684*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUASI-CONTAINERLESS GLASS FORMATION METHOD AND APPARATUS Patent Application
Robert J. Naumann and Edwin C. Ethridge, inventors (to NASA) Filed 5 Dec. 1985 18 p
(NASA-Case-MFS-28090-1; NAS 1.71:MFS-28090-1; US-Patent-Appl-SN-805012) Avail: NTIS HC A02/MF A01 CSCL 11B

In the method of the invention glass rods or fibers are prepared from a polycrystalline rod by heating a short section of the rod in a first furnace to form a molten zone of the rod, heating a second short section of the rod in a second furnace to form a second molten zone and gradually moving the furnaces apart from one another to form an elongated molten float zone, which is cooled in its midsection to produce a glass rod between the molten zones. In another embodiment a single moving furnace assembly and a precursor rod with compositional gradient sections, are used, and the moving furnace traverses the rod so that the molten portion moves through various sections of the rod enabling preparation of glass from reluctant glass-forming compositions. A method and apparatus for producing glass fiber by pulling from molten sections are also disclosed. Novelty of the invention is believd to reside in formation of a molten zone that remains out of contact with container walls during glass formation. This enables preparation of high purity glasses and glasses of novel compositions that are not amenable to preparation by previous methods. NASA

N86-21685*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACETYLENE (ETHYNYL) TERMINATED POLYIMIDE SILOXANE AND PROCESS FOR PREPARATION THEREOF Patent Application
Terry L. St.Clair and Shubha Maudgal, inventors (to NASA) (National Research Foundation) Filed 30 Sep. 1985 14 p
(NASA-Case-LAR-13318-1; NAS 1.71:LAR-13318-1;
US-Patent-Appl-SN-781813) Avail: NTIS HC A02/MF A01 CSCL 11B

Siloxane containing addition polyimides having improved physical property characteristics of flexibility, drape, tack and toughness and the process for preparing and utilizing same are disclosed. The novelty of this invention appears to reside in the composition and process of preparing addition type polyimides useful as structural adhesives as well as composite matrix materials and the process of preparing same. NASA

N86-21686*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMINOPHENOXYCYCLOTRIPHOSPHAZENE CURED EPOXY RESINS AND THE COMPOSITES, LAMINATES AND STRUCTURES THEREOF Patent Application
Devendra Kumar (NRC-NAS), George M. Fohlen, and John A. Parker, inventors (to NASA) Filed 21 Nov. 1985 22 p
(NASA-Case-ARC-11548-1; NAS 1.71:ARC-11548-1;
US-Patent-Appl-SN-806572) Avail: NTIS HC A02/MF A01 CSCL 11B

Aminophenoxycyclotriphosphazenes such as hexakis(4-aminophenoxy)cyclotriphosphazene and tris(4-aminophenoxy)-tris phenoxycyclotriphosphazene are used as curing agents for epoxy resins. These 1,2-epoxy resins are selected from di- or polyepoxide containing organic moieties of the formula (CH2-CHO-CH2)m-W-R-W-(CH2CH-CH2O)m where R is diphenyldimethylmethane, diphenylmethane, bis(dibromophenyl)dimethylmethane. W is a nitrogen or oxygen atom; and m is 1 when W is oxygen and 2 when W is nitrogen. The resins are cured thermally in stages at between about 110 to 135 C for between about 1 and 10 min, then at between about 175 to 185 C for between about 0.5 to 10 hr and post-cured at between about 215 and 235 C for between about 0.1 and 2 hr. These resins are useful for making fire resistant elevated temperature stable composites, laminates (e.g., graphite fiber or fiberglass), molded parts, and adhesives and structures, usually for aircraft secondary structures and for spacecraft construction. NASA

N86-21687# University Coll., Cork (Ireland).
RE-EVALUATION OF SURFACE PROPERTIES OF OXIDE-CATHODE MATERIALS Final Report, 1 Jul. 1984 - 28 Feb. 1985
Joseph Cunningham 15 Jul. 1985 79 p
(Grant AF-AFOSR-0129-84)
(AD-A161131; AFOSR-85-0933TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Surface properties of high-surface-area samples of alkaline earth oxides BaO, MgO, SrO, and CaO - prepared singly as pure materials or as binary systems having BaO dispersed onto the surface of another of the oxides - have been examined using as probes the luminescence and the catalytic activity of the materials. Comparisons of results from the pure systems with those from the binary systems are consistent with extensive reconstruction (rumpling) of the surface layers of the surface-doped binary systems. Such rumpling can produce up to one half of a mono-layer of surface ions jutting out from the surface with a high degree of coordinative unsaturation and resultant high lability and catalytic activity. GRA

N86-21688# Battelle Columbus Labs., Ohio.
PROTOTYPE SALVAGE FOAMING SYSTEM Final Report
J. R. Myers, K. E. Alexander, D. J. Hackman, and D. W. Caudy 4 Nov. 1985 62 p
(Contract N00014-84-C-0145)
(AD-A161499) Avail: NTIS HC A04/MF A01 CSCL 11/9

Polyurethane foam is made by mixing MDI (Polymeric Diphenylmethane Diisocyanate) and polyol together with a blowing agent such as freon, carbon dioxide, or nitrogen. This mixture expands, then hardens. Battelle investigated developments in polyurethane foam formulations and emplacement equipment, to determine what technology could be adapted for underwater foaming. These studies concluded that the combination of high pressure impingement mixing technology (HPIM) and a fast reacting foam formulation would produce an improved foam under water. Based on the information and data gathered during the development of the laboratory model and full-scale prototype foaming machines, including the in-house and at-sea tests, the following conclusions are made: (1) Making high quality foam underwater is feasible to depths of at least 100 feet. Foam densities of less than (10 pounds/cubic feet) can be obtained. (2) The full-scale prototype foaming machine performs well and provides the high degree of control necessary for good foam making. The machine, with its automatic features, is safer to operate, requires less labor to operate and has less down time than previous models. (3) In order to increase the efficient use of chemicals and prevent nozzle clogging, more development work is warranted in the gun and nozzle design. Future machines should use flow meters that are not affected by changes in chemical viscosity (temperature changes+). The heater control system will require further investigation and possibly a re-design, to produce a more stable time/temperature profile. GRA

N86-21689# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
ASYMPTOTIC ANALYSIS OF A MODE 1 CRACK PROPAGATING STEADILY IN A DEFORMATION THEORY MATERIAL
P. P. Casteneda Sep. 1985 30 p
(AD-A161770; MECH-71) Avail: NTIS HC A03/MF A01 CSCL 20/11

The asymptotic stress and deformation fields of a crack propagating steadily and quasi-statically into and elastic-plastic material are present. The material is characterized by J2 deformation theory suitably modified to account for unloading and reloading together with linear strain-hardening. The cases of plane-strain and mode 1 are considered. The associated governing equations are integrated analytically, and the boundary conditions lead to algebraic nonlinear equations which are solved numerically. Results are given for the strength of the singularity, and for the distribution of stress in the plastic loading, elastic unloading and plastic reloading regions, as functions of the strain-hardening parameter. GRA

N86-21690# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
RADIANT-ENERGY PENETRATION EFFECT IN THE THERMAL-DIFFUSIVITY FLASH TECHNIQUE FOR LAYERED AND POROUS POLYMERS
Robert S. Bretzlaff 2 Dec. 1985 37 p Previously announced in IAA as A86-11382

(Contract F04701-85-C-0086)
(AD-A162508; TR-0086(6935-03)-2; SD-TR-85-80) Avail: NTIS HC A03/MF A01 CSCL 11/9

Thermal insulation characterization of polymers and other materials is an important requirement for present and future aerospace missions, as well as for the home construction industry. Some dispersed composites and layered samples have been successfully characterized by the thermal-diffusivity flash technique, while the interpretation of these and other experiments for systems remains problematical. One refinement for layered-sample data reduction is investigated here. An exponentially decaying spatial penetration of radiant energy into the sample is accounted for. Under the conditions chosen for numerical evaluation and 18% reduction in the backface rise time, t1/2, is predicted for a case in which on 5% as much radiant energy is deposited on the midplane as on the front surface. It is experimental methods of estimating the penetration depth of the radiant energy for particular samples. Author (GRA)

N86-21691# Princeton Univ., N. J. Dept. of Chemical Engineering.
THE TIME-TEMPERATURE-TRANSFORMATION (TTT) CURE DIAGRAM OF THERMOSETTING SYSTEMS Technical Report, Nov. 1984 - Dec. 1985
Marc T. Aronhime and John K. Gillham Dec. 1985 68 p
(Contract N00014-84-K-0021)
(AD-A162628; TR-6) Avail: NTIS HC A04/MF A01 CSCL 11/10

An isothermal time-temperature-transformation (TTT) cure diagram for thermosetting systems has been developed to aid in the understanding of the cure process and the properties after cure. The diagram summarizes in a convenient manner the temperature of cure (T sub cure) vs. the times to gelation, vitrification, phase separation (in the case of rubber-modified systems), full cure, and thermal degradation. A more complete diagram could also include contours of constant conversion, viscosity, and modulus. The principal experimental technique which has been used to obtain a TTT diagram, torsional braid analysis (TBA), is described. Two recent models describing the cure process are reviewed; from these the time to vitrification vs. T sub cure is computed from the chemical kinetics and the conversion at vitrification. One model uses a relationship between T sub g and the extent of conversion at vitrification in conjunction with experimental data for the extent of conversion at vitrification, whereas the other predicts the extent of conversion of T sub g from relationships in the literature. Both models predict an S-shaped time to vitrification curve, as has been obtained experimentally. The second model has been applied also to linearly polymerizing systems. GRA

N86-21692# Kingston Polytechnic, Kingston-Upon-Thames (England).
SYNTHESIS OF HYDROPHOBIC, CROSSLINKABLE RESINS Annual Report
G. Pritchard, W. E. Douglas, J. S. Ghotra, and A. E. Matthews Dec. 1985 36 p
(Contract DAJA45-84-C-0016)
(AD-A162702; AD-E301866; AR-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

This is the second annual report of progress in the synthesis of organic, crosslinkable polymers of low water absorption, for use as matrix materials in fiber composites and/or as coatings or adhesives. The approach has been to synthesize low molecular weight, chloromethyl terminated polyethers by the reaction of any of a number of bisphenols with the para or meta isomers of dichloroxylene. Various reaction conditions are described, and the polymers thus produced are discussed briefly. The chloromethyl ends have in one case been converted to vinyl groups by the Wittig reaction, and the resultant unsaturated polymer crosslinked by heat alone without peroxide. Some properties of the crosslinked polymer have been briefly explored, and the low equilibrium water uptake of the product confirmed. Further improvements are necessary in the control of molecular weight distribution and crosslink density before attention turns to fabrication and mechanical property determination. GRA

N86-21693# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
INVESTIGATION OF CHEMICAL DURABILITY MECHANISM IN FLUORIDE GLASSES Annual Report, No. 2, 1 Jul. 1984 - 30 Jun. 1985
Catherine J. Simmons and Joseph H. Simmons 1 Dec. 1985 61 p
(Contract N00014-82-K-0497)
(AD-A162740) Avail: NTIS HC A04/MF A01 CSCL 11/2

Leaching data on two families of fluoride glasses were collected in aqueous media and in solutions buffered at various pH values. The corrosion process was analyzed, leading to the development of a model for dissolution. The dissolution model is broken down into component mechanisms and each component analyzed separately. While many processes take part in the aqueous corrosion of fluoride glasses, the results of these processes have been identified and a quantitative description of each part and of what role it plays in the dissolution of zirconium-fluoride based glasses has been developed. This analysis method is currently being applied to thorium-fluoride glasses and a publication on those results is in preparation. The comparison between the leach rates of different classes of fluoride glasses (ZrLF4, ThF4 and UF4) has been of great value in understanding the effect of composition variations on the leaching processes. Monitoring the pH variations and conducting tests in pH buffered solutions have led to an understanding of the effects which enhance the corrosion rate of these glasses, and which makes them far less durable than silicates. GRA

N86-21694# Virginia Univ., Charlottesville. Dept. of Materials Science.
STUDY OF TRANSPORT PROPERTIES AND STRUCTURE OF EXTENDED-CHAIN POLYMERS Final Report, 1 Oct. 1979 - 31 Mar. 1983
R. Edward Barker, Jr., Kenneth R. Lawless, and Daniel Y. Chen Sep. 1985 283 p
(Grant AF-AFOSR-0014-80)
(AD-A162765; UVA/525631/MS86/103; AFOSR-85-1111TR) Avail: NTIS HC A13/MF A01 CSCL 11/9

Charge, heat, and mass transport in the Air Force's extended chain polymers (especially poly-para-phenylene benzobisthiazole PBT) are related to other electrical, thermal, mechanical nad microstructural properties of the polymers and also compared to these very unusual, highly anisotropic Air Force materials with other materials when it is scientifically relevant or when potential applications may be involved. Special techniques were developed for making transport-property determinations on samples in the form of thin fibers and small area films. Two types of miniature cells were developed in the study of PBT transport properties. A very promising area of the research relates to an anisotropic version of the Barker-Sharbaugh weak electrolyte model for ionic conduction in polymers. A new technique which has been termed the diffusion controlled-differential current (DCDC) method evolved from experiments related to the weak electrolyte model. This DCDC-technique looks promising as a new analytical tool. GRA

N86-21695# Virginia Univ., Charlottesville. Dept. of Materials Science.
STUDY OF TRANSPORT PROPERTIES AND STRUCTURE OF EXTENDED-CHAIN POLYMERS: DIFFUSION AND SOLUBILITY OF GASES Interim Report, 1 Oct. 1981 - 30 Sep. 1982
R. Edward Barker, Jr. and W. S. Huang Sep. 1985 170 p
(Grant AF-AFOSR-0014-80)
(AD-A162766; UVA/525631/MS86/101; AFOSR-85-1110TR) Avail: NTIS HC A08/MF A01 CSCL 11/9

The study of the transport properties in extended chain polymers has added to the understanding of relations between their macroscopic and microscopic properties. There was a need to determine the extent to which a new class of high strength extended chain polymers absorb various vapors and how the vapor

moves within the materials, which have a highly anisotropic fibrous morphology. The main polymer studied as a representative of the class is poly p-phenylene benzobisthiazole (PPBT). An abnormally large heat of sorption (solution) and paradoxical data from two experimental systems with somewhat different conditions are attributed to a large volume fraction of microcavities in PPBT. This hypothesis was shown to be consistent by using the theory of dual sorption. A statistical mechanical model due to diBenedetto was modified to correlate the activation energy with rotation energy and to make possible the prediction of the parallel diffusion coefficient. GRA

N86-21696# Akron Univ., Ohio. Inst. of Polymer Science.
CONTRIBUTION OF BENDING ENERGY LOSSES TO THE APPARENT TEAR ENERGY
A. N. Gent and Jongkoo Jeong Dec. 1985 40 p
(Contract N00014-85-K-0222)
(AD-A162775; TR-2) Avail: NTIS HC A03/MF A01 CSCL 20/11

When a strip is torn, energy is expended both in tearing it and in propagating a bend along each torn section. Estimates are given of the contribution of bending energy losses to the apparent tear energy. Experiments with highly-dissipative semi-crystalline polymers, torn with controlled amounts of bending, are then described. The bending energy losses ranged from 5 to 70 percent of the total tear energy, depending upon the degree of bending imposed, the thickness of the strip, and the extent to which it had been partly cut through before tearing. These results were in satisfactory agreement with approximate theoretical estimates. When the torn strips were allowed to take up naturally bent configurations under the action of the tearing force, then the contribution of bending energy losses to the apparent tear energy became rather independent of the strip dimensions and depended principally upon the dissipative nature of the material, represented by the fraction H of deformation energy that is not recovered. GRA

N86-21697# Dayton Univ., Ohio. Research Inst.
EFFECT OF TEMPERATURE, HUMIDITY, AND LOADING RATE ON THE SHEAR PROPERTIES OF TACTICAL SHELTER CORE MATERIALS Interim Technical Report, Jan. 1981 - May 1983
Ronald J. Kuhbander and Steven J. Caldwell Feb. 1985 64 p
(Contracts F33615-80-C-5011; F33615-82-C-5039)
(AD-A162793; UDR-TR-84-93; AFWAL-TR-84-4178) Avail: NTIS HC A04/MF A01 CSCL 11/4

Honeycomb core shear specimens were prepared and tested using five types of core material, two test methods, and four test conditions. The objective was to determine the effect of loading rate, temperature, and environmental exposure on the shear strength of the various core materials. The results indicated that the core shear strengths were relatively unaffected by loading rate. For all core materials tested, the shear strength decreased with increasing temperature; and humidity aging further decreased the strength. Core shear strength was also found to decrease with increasing core thickness; and the beam shear test method was found to produce higher apparent shear strengths than the plate shear test method. Lastly, glass/phenolic cores (HRP & HTP) were less affected by temperature and humidity than were the paper (WRII), Nomex (HRH-10), or balsa cores. GRA

N86-21698# Sandia National Labs., Albuquerque, N. Mex.
SHOCK-COMPRESSION PROCESSES IN INORGANIC POWDERS
R. A. Graham, B. Morosin, E. L. Venturini, M. J. Carr, and E. K. Beauchamp 1985 10 p
(Contract DE-AC04-76DP-00789)
(DE86-002920; SAND-85-0404C) Avail: NTIS HC A02/MF A01

A large number of inorganic powders have been studied over a range of shock conditions with a number of different material probes. It has been found that the shock compression process caused large plastic deformation and the introduction of dense concentrations of deformation microstructures. The ability to introduce plastic deformation in normal brittle refractory materials is one of the unique aspects of the shock process. DOE

N86-21699# Los Alamos National Lab., N. Mex.
MICROCELLULAR FOAMS VIA PHASE SEPARATION
A. T. Young 1985 23 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract W-7405-eng-36)
(DE86-000784; LA-UR-85-3163; CONF-851174-7) Avail: NTIS HC A02/MF A01

A study of wide variety of processes for making plastic foams shows that phase separation processes for polymers from solutions offers the most viable methods for obtaining rigid plastic foams which met the physical requirements for fusion target designs. Four general phase separation methods have been shown to give polymer foams with densities less than 0.1 g/cm(3) and cell sizes of 30(MU)m or less. These methods involve the utilization of non-solvent, chemical or thermal cooling processes to achieve a controlled phase separation wherein either two distinct phases are obtained where the polymer phase is a continuous phase or two bicontinuous phases are obtained where both the polymer and solvent are interpenetrating, continuous, labyrinthine phases. Subsequent removal of the solvent gives the final foam structure. DOE

N86-21700# Oak Ridge National Lab., Tenn.
AMPHIBOLE CERAMICS: CONCEPTUAL DEVELOPMENT AND PRELIMINARY EXPERIMENTS
R. J. Lauf Aug. 1985 44 p
(Contract DE-AC05-84OR-21400)
(DE86-001445; ORNL/TM-9539) Avail: NTIS HC A03/MF A01

Certain natural silicate minerals, commonly called jade, are well known for their resistance to brittle fracture. One type of jade, nephrite, is a compacted form of the amphibole mineral series tremolite-actinolite. Nephrite is tough because the naturally acicular crystal habit of these amphibole minerals produces an interwoven fibrous microstructure that impedes crack propagation. Object of this work was to duplicate the fibrous microstructure of nephrite by pulverizing natural tremolite or actinolite and then compacting it by hot pressing to form a dense body. Two other materials were also investigated, namely, clinochrysotile (serpentine asbestos) and synthetic fluor-tremolite. For each material, the milling characteristics and densification were studied. The resulting microstructures were characterized, and fracture toughness was measured for a limited number of samples. The most fibrous microstructure was obtained by hot pressing clinochrysotile 15 min a 1000(0)C. Actinolite, hot pressed 15 min at 1100(0)C, had a critical fracture toughness K sub IC = 4.5 MPa m sup 1/2, which compares favorably with the toughness of nephrite jade (K sub IC = 3.6). Decomposition of tremolite and actinolite to more stable phases occurred to some degree during hot pressing. Results suggest that hot isostatic pressing at high water vapor pressure should yield a dense product without causing amphibole decomposition. DOE

N86-21701# California Univ., Berkeley. Lawrence Berkeley Lab.
MORPHOLOGICAL STABILITY OF CONTINUOUS INTERGRANULAR PHASES
W. C. Carter and A. M. Glaeser Jul. 1985 25 p Presented at the 21st University Conference on Ceramic Science, University Park, Pa., 17 Jul. 1985 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE86-001483; LBL-19160; CONF-850705-1) Avail: NTIS HC A02/MF A01

A thermodynamic analysis of the morphological stability of continuous intergranular phases, incorporating the number of bounding grains n, and dihedral angle psi as variables is presented. For each n, the minimum thermodynamically unstable wavelength of an infinitesimal amplitude perturbation coincides with the Rayleigh result for psi = 180(0), increases with decreasing psi and tends to infinity as psi approaches (PI) - (2(PI)/n), or

equivalently as the interface curvature vanishes. For fixed psi, the stability increases with n. Several applications and implications of the analysis are discussed. DOE

N86-21702# General Electric Co., Largo, Fla. Neutron Devices Dept.
QUANTITATIVE METHODS FOR THE CHEMICAL ANALYSIS OF SEALING GLASSES
R. J. Antepenko, J. M. Carter, J. C. Foster, and D. C. Palmer 1985 21 p Presented at the 7th General Electric Company-Wide Materials Characterization Symposium, Schenectady, N.Y., 22 Apr. 1985
(Contract DE-AC04-76DP-00656)
(DE86-001662; GEPP-OP-895; CONF-8504183-2) Avail: NTIS HC A02/MF A01

Sandia developed a high corrosion-resistant glass called TA-23 for application as the header sealing glass in lithium-sulfur dioxide (LAMB) cells. This glass contained a lower silica content and higher alumina content and was far more resistant to lithium electrolyte corrosion at the glass-to-metal seal. The glass functions as the electrical insulator and hermetic seal in the header. Chemical analysis methods were developed for quantitatively measuring the elemental composition of TA-23 glass, which has a nominal composition (wt %) of 45% SiO2, 20% Al2O3, 8% B2O3, 12% CaO, 7% MgO, 6% SrO, 2% La2O3 and 0.05% CoO. Classical wet-chemical methods based on either gravimetric or volumetric procedures were used to measure silica and boric oxide. Instrumental techniques using atomic absorption spectrometry (AAS) and inductively coupled plasma (ICP) - atomic emission spectrometry were used to measure the remaining elements. The sample preparation and analysis procedures will be described for these methods. These methods have also been used to analyze other sealing glasses. DOE

N86-22257# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFECT OF REPEATED LASER IRRADIATION ON ACTIVE LASER GLASSES Abstract Only
R. I. Andreeva, A. P. Kalagin, V. N. Nikolaev, and G. N. Toropkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 3 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 1, Jan. 1985 p 14-17 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-21703*# National Aeronautics and Space Administration, Washington, D.C.
SENSITIVITY OF SOLID EXPLOSIVES: MINIMUM ENERGY OF A DANGEROUS IMPACT
G. T. Afanasyev Mar. 1986 10 p refs Transl. into ENGLISH from Fizika Goreniya i Vzryva (USSR), 1980 p 35-39 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88405; NAS 1.15:88405) Avail: NTIS HC A02/MF A01 CSCL 19A

A method which uses initiating explosives for determining the sensitivity of solid explosives is described. The energy index of sensitivity is determined by the mechanical properties of the explosives. The results of the calculations are discussed. Author

N86-21704*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
DEVELOPMENT OF LC-13C NMR Final Annual Report, 10 Jan. 1984 - 9 Jan. 1985
H. C. Dorn, J. S. Wang, and T. E. Glass 17 Mar. 1986 20 p refs
(Grant NAG3-517)
(NASA-CR-176656; NAS 1.26:176656) Avail: NTIS HC A02/MF A01 CSCL 21D

This study involves the development of C-13 nuclear resonance as an on-line detector for liquid chromatography (LC-C-13 NMR) for the chemical characterization of aviation fuels. The initial focus of this study was the development of a high sensitivity flow C-13 NMR probe. Since C-13 NMR sensitivity is of paramount concern, considerable effort during the first year was directed at new NMR probe designs. In particular, various toroid coil designs were examined. In addition, corresponding shim coils for correcting the main magnetic field (B sub 0) homogeneity were examined. Based on these initial probe design studies, an LC-C-13 NMR probe was built and flow C-13 NMR data was obtained for a limited number of samples. Author

N86-21705# Air Force Armament Lab., Eglin AFB, Fla.
AN EIGHT-INCH DIAMETER, HEAVILY CONFINED CARD GAP TEST
Joseph C. Foster, Jr., Keith R. Forbes, Michael E. Gunger, and B. G. Craig 1985 10 p
(AD-A161557; AFATL-TR-85-98) Avail: NTIS HC A02/MF A01 CSCL 19/4

An instrumented card gap test which is useful for investigating the response of explosives to low pressure, long duration shock stimuli has been developed. The test was designed to screen for an explosive's propensity to detonate or react violently as result of shock induced sympathetic detonation of large ordnance such as general purpose bombs. Both donor and acceptor are encased in an 8-in. outside diameter by 0.35-in. wall steel pipe. Plexiglass of varying thickness and steel end plates are used to control the shock amplitude transmitted to the acceptor. The acceptor is instrumented with piezoelectric time of arrival pins and an armor witness plate. Hydrocode calculations show that the end plates result in significantly longer pressure durations and lower peak pressures than other gap test and is a more realistic mock of the shock loading experienced in large ordnance sympathetic detonation experiments. The results presented includes data for tritonal, composition B, TNT/wax and TNT/NQ/wax. The range of pressure resulting in transition to detonation for different explosives is narrower for this test than that measured in experiments such as the NOL LSGT. Author (GRA)

N86-21706*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE ARMY RESEARCH INSTITUTE UNIT PERFORMANCE RESEARCH AND DEVELOPMENT CENTER Final Report, Aug. 1982 - Jun. 1985
J. L. Fobes Sep. 1985 176 p
(Contract NAS7-918; DA Proj. 2Q2-63743-A-794)
(NASA-CR-176618; NAS 1.26:176618; AD-A161616; ARI-RN-85-97) Avail: NTIS HC A09/MF A01 CSCL 05I

This Research Note describes the activities undertaken by the Jet Propulsion Laboratory (JPL) in support of the development of the Army Research Institute Unit Performance Research and Development Center. The description includes the desirability of conducting research with data from the National Training Center (NTC), the requirement for analysis capabilities away from Fort Irwin itself, and the detailed nature of JPL assistance. GRA

N86-21707# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
F100 FUEL SAMPLING ANALYSIS Final Technical Report, May 1983 - Apr. 1984
L. Q. Maurice Sep. 1985 136 p
(AF Proj. 3048)
(AD-A161667; AFWAL-TR-85-2045) Avail: NTIS HC A07/MF A01 CSCL 21/4

Fuel pump cavitation problems experienced with the F100 engine used in the F-15/F-16 aircraft have led to an extensive fuel analysis program to identify fuel properties that might be contributing to fuel pump failures. This report analyzes the chemical

and physical properties of twenty-one JP-4 fuel samples obtained from United States Air Force Bases. The fuels analyzed met specifications in all but a few isolated cases, and had no unusual properties. If the fuel used is causing fuel pump failure, it must be the result of a fuel property not being measured. The fuels are as good or better than the specification prescribes. It is concluded that the F100 fuel pump cavitation problems are most likely associated with the mechanical complexity built into the design, rather than the result of the fuel used. GRA

N86-21708# Southwest Research Inst., San Antonio, Tex. Belvoir Fuels and Lubricants Research Facility.

FUEL PROPERTY EFFECTS ON THE UNAIDED COLD STARTING OF A TWO-CYCLE DIESEL ENGINE Interim Report, Jan. 1981 - Dec. 1985

Alan F. Montemayor and Edwin C. Owens Dec. 1985 30 p
(Contracts DAAK70-80-C-0001; DAAK70-85-C-0007; DAAK70-82-C-0001)
(AD-A162658; BFLRF-186) Avail: NTIS HC A03/MF A01 CSCL 21/4

In this program, a Detroit Diesel 4-53T was heavily insulated and cooled using a chilled coolant circulation system and cooled combustion air was provided. An external cranking motor was used to turn the engine at a constant rpm. Twenty-one test fuels were blended, and a minimum unaided starting temperature was obtained for each fuel. Multiple linear regression analysis was then performed in order to relate fuel properties to minimum starting temperature. Fuel properties examined were: viscosity; ASTM D 86 and D 2887 boiling point temperatures, cetane number, autoignition temperature, and flash point. Cetane number, viscosity, 50% boiling temperature, and autoignition temperature had statistically significant impact on minimum starting temperature. GRA

N86-21709# Dayton Univ., Ohio.

MULTIDIMENSIONAL HIGH-RESOLUTION GAS CHROMATOGRAPHIC INVESTIGATIONS OF HYDROCARBON FUELS AND VARIOUS TURBINE ENGINE FUEL PRECURSORS Final Report, Apr. - Sep. 1984

Wayne A. Rubey Aug. 1985 89 p
(Contract F33615-83-C-2359)
(AD-A162660; UDR-TR-84-132; AFWAL-TR-85-2033) Avail: NTIS HC A05/MF A01 CSCL 21/4

The instrumental chemical analysis of complex organic mixtures requires efficient chromatographic techniques for the separation and analysis of the mixture constituents. Highly complicated mixtures, such as petroleum crudes, turbine engine fuels, shale oil, composited industrial organic liquid wastes, etc., require the use of high-resolution gas chromatographic (HRGC) techniques. The recent introduction of multidimensional gas chromatographic (MDGC) procedures shows promise of advancing HRGC techniques even further. The literature pertaining to multicolumn and multidimensional procedures was surveyed, and an MDGC system was assembled which used a previously optimized open tubular column gas chromatographic system. Special features were incorporated into this MDGC system which contained a two-column arrangement within a single temperature programmable chamber. The performance of the assembled MDGC system was evaluated and it was determined that for maximum performance of the assembled MDGC system was evaluated and it was determined that for maximum performance to be obtained from such coupled-column assemblies, considerable attention must be given to the design and behavior of each of the many different components within the entire chromatrographic flow path. It was concluded that MDGC represents a valuable additional approach for obtaining high-quality analyses of complex organic mixtures. GRA

N86-21710# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEFECT INSPECTION OF SOLID FUEL PROPELLANT CYLINDERS BY MEANS OF LASER HOLOGRAPHIC TECHNIQUES

Jiang Linzhen, Lue Chichung, and Tsue Chenkuo 13 Dec. 1985 13 p Transl. into ENGLISH from Harbin Gongye Daxue Xuebao (China), no. 1, Mar. 1984 p 56-61
(AD-A162746; FTD-ID(RS)T-0903-85) Avail: NTIS HC A02/MF A01 CSCL 21/9

The theory and practices of applying laser holographic interference techniques in the inspection of solid fuel propellant cylinders for defects such as shield debonds, internal cracks and voids are described. Experimental results obtained from the inspection and testing of solid fuel propellants with the application of heat stress and vacuum stress are reported. GRA

N86-21711# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

PREDICTION OF DETONATION TRANSITION IN POROUS EXPLOSIVES FROM RAPID COMPRESSION LOADINGS Final Report, 30 Aug. 1983 - 10 Sep. 1985

Herman Krier and James R. Stewart 15 Sep. 1985 69 p
(Grant AF-AFOSR-0145-81)
(AD-A162767; IU-UILU-ENG-85-4007; AFOSR-85-1134TR) Avail: NTIS HC A04/MF A01 CSCL 19/4

Increasing the nitramine content of solid rocket propellants increases the overall performance of the system as well as the sensitivity to Shock to Detonation Transition (SDT) and Deflagration to Detonation Transition (DDT). This report deals primarily with the analysis and numerical modeling of a combined SDT/DDT event. The results show that in some instances a zone of burning granulated propellant, confined and adjacent to a zone of cast propellant, can provide a rapid enough pressure-rise rate to shock initiate the cast material. This type of detonation hazard scenario is a real possibility in any high-energy rocket motor environment. The modeling study also indicates areas where important assumptions need to be further researched. These include: (1) relations for dynamic (transient) collapse of the voids or pores; (2) relations for setting the volume percent of hot spots based on initial porosity; (3) the evaluation and expression for the chemical rate of decomposition of the reactive, shocked material; and (4) the assessment of two-phase mixture equilibrium. Author (GRA)

N86-21712# Lawrence Livermore National Lab., Calif.

NEW APPROACH FOR STUDYING THE EXPANSION OF DETONATION PRODUCTS

D. Steinberg and H. Chau Aug. 1985 5 p refs Presented at the 8th International Symposium on Detonation, Albuquerque, N. Mex., 15 Jul. 1985
(Contract W-7405-eng-48)
(DE86-000746; UCRL-93224; CONF-850706-32) Avail: NTIS HC A02/MF A01

Single crystal 100 LiF has well known mechanical and optical properties. Consequently, it has been used for many years as a window when studying inert materials via the velocimeter technique. Because of its close impedance match to detonating HE, this technique was used to probe the expansion of detonation products. Data on LX14 clearly show the Von Neumann spike as well as many other structures not yet identified. The best estimate for the CJ pressure is 35.3 GPa. DOE

N86-21713# Sandia National Labs., Albuquerque, N. Mex.

APPLICATION OF HYDROGEN ANALYSIS TO THE COMPATIBILITY TESTING AND LONG-TERM AGING OF EXPLOSIVES

S. E. Klassen and J. E. Womelsduff Sep. 1985 16 p refs
(Contract DE-AC04-76DP-00789)
(DE86-001689; SAND-85-1686) Avail: NTIS HC A02/MF A01

The addition of a hydrogen transfer system (Carle Instruments) to a Hewlett-Packard 5880A gas chromatograph has enabled us to quantitate hydrogen in addition to other gases produced during compatibility testing of explosives. This report describes our particular modification and gives results which describe its capabilities. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-21714* Philips Labs., Briarcliff Manor, New York.
DESIGN AND FABRICATION OF A LONG-LIFE STIRLING CYCLE COOLER FOR SPACE APPLICATION. PHASES 1 AND 2: ENGINEERING MODEL Final Report, 29 Sep. 1978 - 31 Dec. 1982
F. Stolfi, M. Goldowsky, C. Keung, L. Knox, E. Lindale, R. Maresca, J. Ricciardelli, and P. Shapiro Mar. 1983 221 p refs
(Contract NAS5-25172)
(NASA-CR-175288; NAS 1.26:175288; PL-11-CR83-0307)
Copyright. Avail: Issuing Activity CSCL 13I

A model of a Stirling cycle cryogenic refrigerator capable of producing 5 Watts of cooling at 65 deg Kelvin was tested. The cooler demonstrated the concept feasiblity of providing refrigeration for long-life, reliable operation in spaceborne missions. Linear, moving-magnet, electric motors provide a direct-drive mechanism. The moving mechanical elements, the piston and displacer, are supported with linear magnetic bearings which provide nonlubricated, contact-free operation. The pressure seals are formed by long, narrow, annular gaps, thereby eliminating the possibility of performance degradation by mechanical wear. Electronic control of the axial position of the piston and displacer permits independent adjustment of their amplitudes and phase relationship during operation. All internal parts are fabricated of only metal and ceramic components, thereby removing all forms of organic contamination. This synergistic approach omits all the life limiting aspects of conventional Stirling cycle machines. The steps taken to combine the thermodynamic, mechanical, magnetic, and electronic features of this work into a successfully operating refrigerator are described. For individual titles, see N86-21715 through N86-21717.

N86-21715* Philips Labs., Briarcliff Manor, New York.
INTRODUCTION TO DESIGN AND FABRICATION OF A LONG-LIFE STIRLING CYCLE COOLER FOR SPACE APPLICATION. PHASES 1 AND 2: ENGINEERING MODEL Final Report
In its Design and Fabrication of a Long-Life Stirling Cycle Cooler for Space Application. Phases 1 and 2: Engineering Model Mar. 1983 184 p (For primary document see N86-21714 12-31)
Avail: Issuing Activity CSCL 13I

A concept for a cryogenic refrigerator capable of long-life, reliable operation in space was proposed. The proposed concept was translated into a design phase in which the critical components were tested in dedicated fixtures and by the fabrication and test of a laboratory prototype with which to demonstrate the feasibility of the proposed concept. The engineering model program concept feasibility and addressed, the problems of efficiency, long life, and reliability. The cooler uses the Stirling cycle, a thermodynamically reversible process, as its refrigeration method. To attain the desired life and reliability, its design incorporates features which eliminate wear and reduce working-gas contamination. Efforts associated with, design, manufacturing, and testing of the engineering model are reported. E.A.K.

N86-21716* Philips International B.V., Eindhoven (Netherlands).
A SMALL FREE-PISTON STIRLING REFRIGERATOR Final Report
A. K. deJonge *In its* Design and Fabrication of a Long-Life Stirling Cycle Cooler for Space Application. Phases 1 and 2: Engineering Model Mar. 1983 7 p refs (For primary document see N86-21714 12-31)
Avail: Issuing Activity CSCL 13I

The performance characteristics of Stirling machines with free moving pistons were studied. The design of the small free piston Stirling refrigerator, is described and a new way to describe the pressure fluctuations in the Stirling system is given. The equations of movement of the piston and the displacer are derived. A small cryogenic cooler, based on the free displacer Stirling principle, was designed and developed with a capacity of 1 W at 77 K. The main application is for infrared radiation detection. The concept leads to a machine with a very long life requiring no maintenance and having negligible degradation. The machine, has shown a long lifetime and a very stable lowest temperature. The pressure fluctuation in the machine which leads to an explanation of the behavior of a free displacer refrigerator is descrbed and the linear drive system of the machine is discussed. E.A.K.

N86-21717* Philips Labs., Briarcliff Manor, New York.
[BASIC PRINCIPLES OF THE STIRLING CYCLE] Final Report
In its Design and Fabrication of a Long-Life Stirling Cycle Cooler for Space Application. Phases 1 and 2: Engineering Model Mar. 1983 16 p refs (For primary document see N86-21714 12-31)
Avail: Issuing Activity CSCL 13I

The basic principles of the Stirling cycle are outlined. From an elementary theory the general properties of the cycle are derived with a discussion of the most important losses. The performance of the fundamental and ideal (isothermal) cycle are described. The actual cycle, which differs from the ideal one by the occurrence of losses is also described. In the ideal Stirling cycle, the cold is produced by the reversible expansion of a gas. The gas performs a closed cycle, during which it is alternately compressed at ambient temperature in a compression space and expanded at the desired low temperature in an expansion space, thereby reciprocating between these spaces through one connecting duct, wherein a regenerator provides for the heat exchange between the outgoing and the returning gas flow. The problem of how to minimize the total sum of the losses is examined. E.A.K.

N86-21718* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTAINERLESS HIGH PURITY PULLING PROCESS AND APPARATUS FOR GLASS FIBER Patent
Robert J. Naumann and Edwin C. Ethridge, inventors (to NASA) Issued 21 Jan. 1986 6 p Filed 19 Apr. 1984 Continuation-in-part of US-Patent-Appl-SN-526754, filed 26 Aug. 1983, abandonded
(NASA-Case-MFS-25905-2; US-Patent-4,565,557;
US-Patent-Appl-SN-601130; US-Patent-Class-65-1;
US-Patent-Class-65-2; US-Patent-Class-65-11.1;
US-Patent-Class-65-12) Avail: US Patent and Trademark Office CSCL 13H

Apparatus and method for pulling optical glass fibers in a containerless environment is disclosed which includes a single axis acoustical levitation furnace in which a specimen is levitated and melted. A reflector unit is carried in the interior of the furnace and includes a reflector disposed centrally about the acoustical axis of the levitator. The reflector unit includes a circular shroud of insulation and a copper sleeve inserted in the unit which is hollow at for receiving a cooling medium. A fiber pulling bore is formed centrally in the reflector unit surrounded by cooling jacket to enhance solidification and formation of a fiber. A starting fiber strand is introduced into the melt and pulled outwardly through bore whereby the specimen fiber is started and formed as pulled therethrough. In order to replenish the melt and thus enable a continous process, a movable secondary reflector is provided which captures a supplemental specimen pellet and by movement of the reflector transfers it to the melt.

Official Gazette of the U.S. Patent and Trademark Office

N86-21719*# National Aeronautics and Space Administration, Washington, D.C.
REMOVAL OF GLASS ADHERED TO SINTERED CERAMICS IN HOT ISOSTATIC PRESSING
Nov. 1985 11 p Transl. into ENGLISH of Japanese Patent no. 58-88177 (26 May 1983) p 1-5 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(NASA-TM-77930; NAS 1.15:77930) Avail: NTIS HC A02/MF A01 CSCL 13H

In the hot isostatic pressing of ceramic materials in molten glass using an inert gas as a pressing medium, glass adhered to the sintered ceramics is heated to convert it to a porous glass and removed. Thus, Si3N4 powder was compacted at 5000 kg/sq cm, coated with a 0.5 mm thick BN, embedded in Pyrex glass in a graphite crucible, put inside a hot isostatic press containing

Argon, hot pressed at 1750 C and 100 kg/sq cm; cooled, taken out from the crucible, heated at 1100 C for 30 minutes, cooled, and then glass adhered to the sintered body was removed. Author

N86-21720*# National Aeronautics and Space Administration, Washington, D.C.
APPARATUS FOR EDGE ETCHING OF SEMICONDUCTOR WAFERS
A. Casajus Feb. 1986 13 p Transl. into ENGLISH of East German Patent no. 143,333 (13 Aug. 1980) p 1-11 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77998; NAS 1.15:77998) Avail: NTIS HC A02/MF A01 CSCL 13H

A device for use in the production of semiconductors, characterized by etching in a rapidly rotating etching bath is described. The fast rotation causes the surface of the etching bath to assume the form of a paraboloid of revolution, so that the semiconductor wafer adjusted at a given height above the resting bath surface is only attacked by etchant at the edges. Author

N86-21721# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES. VOLUME 39, NUMBER 12
Larry E. Shaffer Dec. 1985 55 p
(AD-A161069; ESN-39-12) Avail: NTIS HC A04/MF A01 CSCL 05/2

Progress in European science and technology is reported. Topics discussed in this issue include: bioelectromagnetic featured at ONRL Minisymposium on the influence of electric and electromagnetic fields on organized biological structures; neurobiology research at the universities of Stockholm, Lund, and Goeteborg (Sweden); conference on parallel computing; General Electric Co. (UK) research at Hirst and Marconi; research centres--information technology, image processing and analysis, radars communications, and semiconductors; and fatigue research at the Univ. of Vienna on short crack (less than 0.5 mm). GRA

N86-21722# Department of the Army, Washington, D. C.
METHOD OF CHEMICALLY POLISHING QUARTZ CRYSTAL BLANKS Patent Application
Ronald J. Brandmayr, inventor (to Army) Filed 30 Sep. 1985 14 p
(AD-D011975; US-Patent-Appl-SN-781166) Avail: NTIS HC A02/MF A01 CSCL 07/1

The general object of this invention is to provide a method of chemically polishing quartz crystal blanks. A more specific object is to provide such a method wherein the resulting chemically polished blanks will be suitable for use in resonators and oscillators. Quartz crystal blanks are chemically polished by thoroughly cleaning the blanks, treating the quartz crystal blanks with an etching solution at high pressures in a high pressure vessel while agitating to circulate the etchant and maintaining a uniform temperature throughout the etching solution, cooling the vessel, removing the quartz crystal blanks, rinsing thoroughly with water and spinning dry. GRA

N86-21723# Joint Publications Research Service, Arlington, Va.
JAPAN REPORT: SCIENCE AND TECHNOLOGY
10 Jan. 1986 59 p refs Transl. into ENGLISH from various Japanese articles
(JPRS-JST-86-001) Avail: NTIS HC A04/MF A01

Progress in Japanese science and technology is reported. Topics discussed include: aerospace sciences, chemical engineering, energy, nuclear development, and science and technology policies. For individual titles, see N86-21724 through N86-21726.

N86-21724# Joint Publications Research Service, Arlington, Va.
EARTH SENSOR FOR ARTIFICIAL SATELLITE CONTROL DISCUSSED c35
Kunio Nakamura and Matsushita Giken *In its* Japan Report: Science and Technology (JPRS-JST-86-001) 10 Jan. 1986 p 1-12 refs Transl. into ENGLISH from Sensa Gijutsu (Tokyo, Japan), May 1985 p 69-74 (For primary document see N86-21723 12-31)
Avail: NTIS HC A04/MF A01

Confirmation of the state of satellite operation and the appropriate control of satellite attitude was examined. A certain attitude is necessary to put a satellite in its planned orbit after launched by a ground rocket while, weight is an important design item in the launching of satellites and the amount of fuel used for attitude control must be minimized, but this hinges on how precisely the attitude can be detected. Attitude control is important to any satellite, whether a meteorological satellite, communications satellite, or broadcasting satellite. Satellites are designed so that their attitude can be detected by sensors. The Earth sensor is important to application satellites operated around the Earth. This sensor has the function of deciding the attitude of a satellite to the Earth and can decide two of the three attitude axes. An attitude detecting system is designed by combining it with the solar sensor to decide all three axes. E.A.K.

N86-21725# Joint Publications Research Service, Arlington, Va.
FIBER REINFORCED PLASTICS DESCRIBED c24
In its Japan Report: Science and Technology (JPRS-JST-86-001) 10 Jan. 1986 p 19-42 Transl. into ENGLISH from Nikko Materials (Tokyo, Japan), Jan. 1985 p 85-96 (For primary document see N86-21723 12-31)
Avail: NTIS HC A04/MF A01

The development of fiber reinforced plastics (FRP) in Japan is described. During the years of development of new FRP products, was made in molding FRP materials to produce FRP products. The molding method progressed from the band lay-up molding to the spray-up molding to the hot press molding to the preform MMD molding to the SMC molding. The development of these molding methods has contributed to the resultant progress of the FRP industry in Japan. E.A.K.

N86-21726# Joint Publications Research Service, Arlington, Va.
TDK AFFILIATE DEVELOPS NEW SOLAR POWER CELL c44
In its Japan Report: Science and Technology (JPRS-JST-86-001) 10 Jan. 1986 p 52 Repr. from Kyodo (Tokyo, Japan), 0727 GMT, 21 Nov. 1985 (For primary document see N86-21723 12-31)
Avail: NTIS HC A04/MF A01

A solar power generating cell capable of changing sunlight into electricity more efficiently, paving the way to produce commercially viable solar power generators was developed. The amorphous noncrystal photovoltaic cell will lead to wide use of solar power stations by electric power companies. Photovoltaic cells generate voltage when radiant energy fall on the boundary between dissimilar semiconductors. Amorphous cells will be used for large-scale power generating systems because they are more economical and efficient than costly crystal semiconductor cells. A square prototype-1 cm by 10 cm-consisting of 15 amorphous cells was produced its laser technology. The prototype converts 9.9% of solar heat into electric energy, more efficient than conventional amorphous cells, which convert about 8%. E.A.K.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-21727*# National Aeronautics and Space Administration, Washington, D.C.
IONOSPHERIC EFFECTS TO ANTENNA IMPEDANCE
Karl-Heinz Bethke Jan. 1986 25 p refs Transl. into ENGLISH of Ionpsphaereninfluss auf die Antennenimpedanz (Bochum, West Germany), Dec. 1980 p 1-25 Original language doc. was announced as N85-28217 Transl. by SCITRAN, Inc., Santa Barbara, Calif. Original doc. prep. by Ruhr Univ., Bochum, West Germany

(Contract NASw-4004)
(NASA-TM-77956; NAS 1.15:77956; BMFT-FB-W-84-052) Avail: NTIS HC A02/MF A01 CSCL 20N

The reciprocity between high power satellite antennas and the surrounding plasma are examined. The relevant plasma states for antenna impedance calculations are presented and plasma models, and hydrodynamic and kinetic theory, are discussed. A theory from which a variation in antenna impedance with regard to the radiated power can be calculated for a frequency range well above the plasma resonance frequency is give. The theory can include photo and secondary emission effects in antenna impedance calculations. Author

N86-21728# Illinois Univ., Urbana. Coordinated Science Lab.
AN EXPERIMENTAL STUDY OF DIELECTRIC ROD ANTENNAS FOR MILLIMETER-WAVE IMAGING APPLICATIONS
S. H. Doran and R. Mittra Apr. 1985 23 p
(Contract N00014-84-C-0149)
(AD-A161350; R-1037; UILU-ENG-85-2212) Avail: NTIS HC A02/MF A01 CSCL 17/9

In this report, the results of an experimental investigation of dielectric antennas for application in an imaging radar at millimeter wavelengths are presented. Several designs for the antenna were tested for use at 81 or 220 GHz and critical design features for these antennas were studied. A simple design for an imaging radar using dielectric antennas was also implemented and field maps were obtained for a series of simple test objects. GRA

N86-21729# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF WAVEGUIDE MODES ON THE SCATTERING OF A FINITE TUBULAR CYLINDER M.S. Thesis
Gyoo Phil Chung Sep. 1985 101 p
(AD-A161500) Avail: NTIS HC A06/MF A01 CSCL 20/14

This thesis is a study of the back scattering of finite tubular cylinders with circular cross-sections and very thin conducting walls. Measurements of several scaled tubular cylinders were taken and the experimental results were compared to theoretical data and to previous results, respectively. This research is part of an ongoing project to investigate the resonant scattering characteristics of targets. The results are expected to find applications in target identification. GRA

N86-21730# Illinois Univ., Urbana. Computer Systems Group.
THE METHOD OF CONJUGATE GRADIENTS FOR THE NUMERICAL SOLUTION OF LARGE-BODY ELECTROMAGNETIC SCATTERING PROBLEMS
A. F. Peterson and R. Mittra Mar. 1985 30 p
(Contract N00014-84-C-0149)
(AD-A161550; R-1035; UILU-ENG-85-2210) Avail: NTIS HC A03/MF A01 CSCL 20/14

Over the past few decades, many techniques have been developed for the numerical solution of integral equations representing electromagnetic scattering problems. However, a majority of these techniques are limited to electrically small scatterers, i.e., below the resonance range. This is primarily because the amount of CPU computer time and storage requirements become prohibitive for large body scatterers. Recent work indicates that a procedure based on the iterative conjugate gradient method can be incorporated into conventional numerical methods in order to extend the range of application of the techniques to larger geometries. In this paper we discuss the conjugate gradient method and illustrate several ways in which it can be applied to electromagnetic scattering problems. The discussion includes mention of the method as compared to conventional approaches as well as some of its limitations. In many practical scattering problems of interest at optical wavelengths, the method can provide a convenient means of treating problems which are electrically more than an order of magnitude larger than can be handled by other techniques.
Author (GRA)

N86-21731# Computer Systems Management, Inc., Arlington, Va.
DESIGN, DEVELOPMENT, AND INSTALLATION OF A TWO-NODE, COLOR VIDEO-TELECONFERENCING SYSTEM FOR THE US NAVY Final Technical Report, 27 Jul. 1984 - 28 Sep. 1985
Kevin F. Vest, Patrick Jones, Douglas French, Harvey Sachs, and Frances Clements 1 Nov. 1985 48 p
(Contract MDA903-84-C-0008; ARPA Order 3829)
(AD-A161614; CSMI/TR-85/02) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report discusses the design of a two-node, color Video-Teleconferencing System for the System for the U.S. Navy and its installation at sites in Suitland, Maryland, and Pearl Harbor. It details the development of the audio, video, and fast-facsimile parts of the system; integration of the system into the communications network; design of a teleconference room; and installation of the system. GRA

N86-21732# Naval Research Lab., Washington, D. C.
USING SPECTRAL ESTIMATION TECHNIQUES IN ADAPTIVE PROCESSING ANTENNA SYSTEMS Interim Report
W. F. Gabriel 9 Oct. 1985 42 p
(DA Proj. WR0-2101)
(AD-A161670; NRL-8920) Avail: NTIS HC A03/MF A01 CSCL 09/5

Improved spectral estimation techniques are applied to adaptive processing array antenna systems. They are invaluable because the amount of additional useful information they can provide about the interference environment, utilizing only a relatively small number of degrees-of-freedom (DOF). Two conceptual application area examples that use such techniques are discussed; partially-adaptive low-sidelobe arrays, and fully-adaptive tracking arrays. For the partially-adaptive area, the information is used for the efficient assignment of a limited number of DOF in a beamspace constrained adaptive system to obtain a stable mainbeam, retention of low sidelobes, considerably faster response, and reduction in overall cost. These benefits are demonstrated via simulation examples computed for a 16-element linear array. For the fully adaptive tracking array area, the information is used in an all-digital processing system concept to permit stable nulling of coherent interference sources in the mainbeam region, efficient assignment/control of the available DOF, and greater flexibility in time-domain adaptive filtering strategy. GRA

N86-21733# National Oceanic and Atmospheric Administration, Boulder, Colo.
DATA ANALYSIS OF THE NOAA-GIT (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION-GEORGIA INSTITUTE OF TECHNOLOGY) MILLIMETER-WAVE PROPAGATION EXPERIMENT NEAR FALTVILLE, ILLINOIS Technical Report
R. J. Hill, W. P. Schoenfeld, J. P. Riley, J. T. Priestley, and S. F. Clifford Aug. 1985 61 p
(Contract MIPR-ARO-122-85 29)
(AD-A161722; NOAA-TR-ERL-429-WPL-60; ARO-18029.7-GS) Avail: NTIS HC A04/MF A01 CSCL 20/14

The authors discuss the quantities calculated from the millimeter-wave and micrometeorological data base. The data base was obtained from the millimeter-wave propagation experiment conducted near Flatville, Illinois, by the National Oceanic and Atmospheric Administration (NOAA) and Georgia Institute of Technology (GIT). The repair of data-base errors by digital computation is also discussed, and the overall structure of the data-processing programming is described. GRA

N86-21734# City Coll. of the City Univ. of New York. Communications Systems Lab.
SPREAD SPECTRUM ACQUISITION AND TRACKING Final Report, 30 Jun. 1984 - 30 Jun. 1985
Donald L. Schilling and H. Kayser 8 Nov. 1985 51 p
(Grant AF-AFOSR-0102-83)
(AD-A162442; AFOSR-85-1066TR) Avail: NTIS HC A04/MF A01 CSCL 17/4

This report discusses the following subjects: An acquisition scheme for a frequency-hopped SS signal received over a Rayleigh multipath channel with random delay time. We consider relatively fast FH with a hopping rate of 1 KHZ and 127 different hopping

frequencies. The received signal is embedded in white Gaussian noise. While the above problem appears to be specific the approach given below is general and can be generalized further. In this case, ignoring the spreading effect, there will be a possible overlapping between only three adjacent frequencies. For such a case we propose an optimum receiver and acquisition scheme whose characteristics are analyzed mathematically and by computer simulation. We characterize the performance of the acquisition scheme by the probability of detection for given probability of false acquisition when the input signal is white Gaussian noise only. The probability of detection is the probability that, at the end of the observation period, the desired signal code sequence is detected. GRA

N86-21735# Illinois Univ., Urbana. Coordinated Science Lab.
DIVERSITY COMBINING FOR FREQUENCY-HOP SPREAD-SPECTRUM COMMUNICATIONS WITH PARTIAL-BAND INTERFERENCE AND FADING Ph.D. Thesis
Catherine M. Keller Oct. 1985 115 p
(Contract N00014-84-C-0149)
(AD-A162495; UILU-ENG-85-2228) Avail: NTIS HC A06/MF A01 CSCL 17/2

This report presents results on the evaluation of several diversity combining techniques that are suggested for frequency-hop (FH) communications with partial-band interference and fading. The analysis covers systems with M-ary orthogonal signaling and noncoherent demodulation. The partial-band interference is modeled as a Gaussian process, although some of the results also apply to general (non-Gaussian) partial-band interference. The performance measures we use to evaluate the diversity combining techniques are the narrowband interference rejection capability and the signal to noise ratio requirement over the entire range of interference duty factors. We evaluate the exact probability of error for each of the diversity combining techniques studied. The performance of the optimum combining technique for receivers with perfect side information is established. It is shown that for receivers with perfect side information, the system performance does not change significantly with the choice of the diversity combining technique. However, the same schemes that work well in receivers with perfect side information perform poorly in receivers without side information. GRA

N86-21736# ALPHATECH, Inc., Burlington, Mass.
SPECIFICATION AND PRELIMINARY VALIDATION OF IAT (INTEGRATED ANALYSIS TECHNIQUES) METHODS: EXECUTIVE SUMMARY
Judith R. Kornfeld Mar. 1985 34 p
(Contract F33615-82-C-0509)
(AD-A162509; TR-223; AFAMRL-TR-85-003) Avail: NTIS HC A03/MF A01 CSCL 17/2

Since FY83 work has been conducted to develop a methodology for the description and analysis of complex Command, Control, and Communications (C3) systems. The methodology will explicitly consider the human role in such systems, as well as organizational and equipment constraints. The methodology developed under this effort will be a set of interrelated techniques, thus the title Integrated Analysis Techniques (IAT) has been chosen. This report outlines work to date, including the identification of requirements for IAT, development of an IAT conceptual framework, and preliminary validation of IAT concepts. Planned work for FY85, including more extensive validation, is also described. IAT is being developed to provide quantitative information about C3 human/system performance. This information can then be used to guide the analysis and design of new systems as well as the improvement or reconfiguration of existing ones. GRA

N86-21737# Ohio State Univ., Columbus. Electroscience Lab.
SPACE-FREQUENCY SAMPLING CRITERIA FOR ELECTROMAGNETIC SCATTERING OF A FINITE OBJECT
Frederic Y. S. Fok Aug. 1985 202 p
(Contract N00014-82-K-0037)
(AD-A162553; ESL-714190-11) Avail: NTIS HC A10/MF A01 CSCL 20/14

This investigation concerns the sampling criteria in the wave number space for generating the spatial impulse response of a finite target. The impulse response of a finite target is important for target identification and imaging. The other purpose of this report is in the management of large amounts of data for potential application in the presentation of scattered field data and construction of such images. For clarity, monostatic impulse responses of up to two dimensions are considered. A proper choice of canonical confinement for the target in space can greatly reduce the number of samples required to sufficiently characterize the target's spatial impulse response. One dimensional impulse responses generated using two basic types of confinement: 1) isotropic and 2) parallelepiped, are compared. The two approaches show competitive reconstructed results. Though a sampling lattice may be more efficient in the sense of a reduced number of measurement points, it may be less effective when digital processing is involved. Specifically, the time consuming interpolation step is required to put data presented in other types of sampling lattice into the cubic type. Two dimensional impulse responses reconstructed from cubic sampled data are compared with those using Mensa et al., method. Two dimensional impulse responses obtained also indicate good potentials for image reconstruction via the spatial impulse response. GRA

N86-21738# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
SEQUENTIAL DECODING FOR MULTIPLE ACCESS CHANNELS Ph.D. Thesis
Erdal Arikan Dec. 1985 115 p
(Contract N00014-84-K-0357; DARPA Order 3045)
(AD-A162630; LIDS-TH-1517) Avail: NTIS HC A06/MF A01 CSCL 17/2

Sequential decoding is a decoding algorithm for tree codes originally developed for single-user channels (i.e., channels with one transmitter and one receiver). Sequential decoding relies on what is called a metric to direct its search and find the path in the tree that corresponds to the encoded message. The decoding complexity in sequential decoding, that is, the number of computations to decode a source digit, is a random variable. A rate is said to be achievable by sequential decoding if it is possible to select a code with that rate and a metric such that the expected value of the decoding complexity is finite. In the single-user case, the largest achievable rate is called the cut-off rate of sequential decoding. Multiple access channels are models of communication systems where there are a number of users all sharing the same transmission medium to communicate their messages to a common receiver. This thesis explores the possibility of using sequential decoding on multiple access channels. GRA

N86-21739# Maxim Technologies, Inc., Santa Clara, Calif.
ADAPTIVE ANTENNA NULLING PERFORMANCE IN A DISPERSIVE PROPAGATION MEDIUM Technical Report, 15 Sep. 1983 - 15 Jan. 1985
Ronald Y. Ibaraki and Ernest T. Tsui 15 Feb. 1985 58 p
(Contract DNA001-83-C-0321)
(AD-A162708; AD-E301864; MT-TR-8502S; DNA-TR-85-75) Avail: NTIS HC A04/MF A01 CSCL 17/4

The Signal-to-Interference pulse Noise Ratio (SINR) performance of a generic Multi-Beam Antenna (MBA) and a Thinned Phased Array Antenna (TPAA) is evaluated for multiple jammer scenarios including the effect of angle-of-arrival distortion of the jamming signals caused by a striated propagation media. The analysis is based on computer modeling of the antenna configurations using the optimal Wiener solution for the adaptive weight calculations. Statistically distributed SINR values in fading are obtained by applying the equivalent effect of independent two-dimensional sample functions of spatially varying flat fading at the antenna aperture. GRA

N86-21740# Department of the Army, Washington, D. C.
SAW (SURFACE ACOUSTIC WAVE) TRANSITION DETECTOR FOR PSK (PHASE SHIFT KEYING) SIGNALS Patent Application

William J. Skudera, Jr. and Charles E. Konig, inventors (to Army) Filed 1 Nov. 1985 20 p
(AD-D011974; US-Patent-Appl-SN-793931) Avail: NTIS HC A02/MF A01 CSCL 17/2

This disclosure related to a phase transition detector for PSK signals which utilizes a dual channel SAW differential delay line to achieve a required delay. Each channel or path of the SAW device comprises an input and an output transducer. The two channels provide a predetermined differential delay (T) inasmuch as they are of different lengths. A PSK input signal is delivered to a power splitter, with the output therefrom coupled to the pair of input transducers of the SAW device. The output transducers are coupled to a multiplier which serves to detect phase transitions in the input PSK signal. The multiplier output is coupled to an output terminal via a low pass filter which provides harmonic repression. In another embodiment a SAW device comprises a bank if dual channel differential delay lines with each channel set to a different predetermined delay (T) so that a plurality of PSK signals of different chip rates can be separated out and detected. The PSK input signals are delivered to a power splitter, with the output thereform coupled to a pair of input transducers of the SAW device. Output transducers are spaced predetermined distances from one or the other of said input transducers. Parallel sets of multipliers and low pass filters are coupled to predetermined SAW output transducers. Each multiplier serves to detect the phase transitions in one, and only one, PSK input signal. GRA

N86-21741# Department of the Air Force, Washington, D.C.
RADAR-CLUTTER SIMULATOR Patent Application
Gregory Schaaf, inventor (to Air Force) Filed 4 Sep. 1985 12 p
(AD-D011992; US-Patent-Appl-SN-772581) Avail: NTIS HC A02/MF A01 CSCL 17/9

The simulation of clutter echo return signals for a radar system is accomplished using two sets of diode noise sources, a frequency synthesizer for bandwidth control, multiplexing control, two D/A converters and mixers, a 90-degree splitter, and a summer; the output of the summer being the simulated clutter. The two sets of noise sources each produce a digital encoded controlled bandwidth Gaussian noise signal which is strobed by the multiplexing control unit firstly to the pulse repetition interval of the radar system and secondly to the data rate of the radar system. The two strobed D/A converters convert the two digital noise signals into their analog equivalents. The two separate video channels are required to obtain the Rayleigh noise distribution characteristic of clutter. This distribution results when the analog signals from the D/A converters are multiplied with in-phase and quadrature RF reference frequencies in the two mixers, then summed in the summer. GRA

N86-21907# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STRUCTURAL DAMPING POTENTIAL OF WAVEGUIDE ABSORBERS
Eric E. Ungar and Leonard G. Kurzweil *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 14 p refs
(For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-21742* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LINEARIZED TRAVELING WAVE AMPLIFIER WITH HARD LIMITER CHARACTERISTICS Patent
Henry G. Kosmahl, inventor (to NASA) Issued 14 Jan. 1986 7 p
Filed 20 Mar. 1985 Continuation-in-part of US-Patent-Appl-SN-492522, filed 9 May 1983, abandonded
(NASA-Case-LEW-13981-2; US-Patent-4,564,787;
US-Patent-Appl-SN-714051; US-Patent-Class-315-3.6;
US-Patent-Class-315-3.5; US-Patent-Class-315-39.3;
US-Patent-Class-330-43) Avail: US Patent and Trademark Office CSCL 09A

A dynamic velocity taper is provided for a traveling wave tube with increased linearity to avoid intermodulation of signals being amplified. In a traveling wave tube, the slow wave structure is a helix including a sever. A dynamic velocity taper is provided by gradually reducing the spacing between the repeating elements of the slow wave structure which are the windings of the helix. The reduction which takes place coincides with the ouput point of helix. The spacing between the repeating elements of the slow wave structure is ideally at an exponential rate because the curve increases the point of maximum efficiency and power, at an exponential rate. A coupled cavity traveling wave tube having cavities is shown. The space between apertured discs is gradually reduced from 0.1% to 5% at an exponential rate. Output power (or efficiency) versus input power for a commercial tube is shown.
Official Gazette of the U.S. Patent and Trademark Office

N86-21743 Stanford Univ., Calif.
POINT DEFECTS AND DOPANT DIFFUSION IN SILICON Ph.D. Thesis
Paul Martin Fahey 1985 246 p
Avail: Univ. Microfilms Order No. DA8522139

Since dopant atoms are substitutional in nature, they become mobile only by interacting with the native point defects of the silicon lattice. Dopant diffusion by the vacancy, interstitial, and interstitialcy mechanisms are examined from an energetics viewpoint. Both the charge states of the defects and the chemical identity of the dopant atoms are variables in the analysis. Relationships between dopant and point defect concentrations are examined under equilibrium and non-equilibrium conditions, and the appropriate equations governing diffusion presented. It is demonstrated that exposure of the silicon surface to NH3 ambient at elevated temperatures caused vacancy defects to be injected into the silicon bulk, while exposure of SiO2 layers of SiO2 layers to NH3 results in injected of interstitial type defects. These thermal nitridation processes are used to study the diffusion of the common dopants, P, As, Sb, and B. By selectively injecting vacancies or interstitials into the bulk and monitoring the changes in diffusion rates through spreading resistance or SIMS profile analysis, the types of mechanisms by which the dopants diffuse can be ascertained. Dissert. Abstr.

N86-21744 Stanford Univ., Calif.
COMPLEXITY RESULTS IN VLSI AND DISTRIBUTED COMPUTING Ph.D. Thesis
King Fai Pang 1985 164 p
Avail: Univ. Microfilms Order No. DA8522210

Two classes of complexity problems are investigated in this thesis. For the first class, namely, VLSI Complexity, the main results are bounds on combinations of the area A, computation time T and pipelined period P expended by a VLSI circuit in solving a problem. Based on the Grid Model for VLSI circuits, a unified framework for formalizing circuit partitions is developed. Multiple circuit partitions in two- and three-dimensions are introduced. Employing these proof methods, matching (or the strongest known) lower and upper bounds are derived for a class of functions with localized information flow. These include: generalized discrete Fourier transform, generalized barrel shift and rectangular matrix multiplication. Formal definitions are given to derive general complexity bounds for four communication models. They are the deterministic, epsilon-error, epsilon-randomized and delta-distortion models. Dissert. Abstr.

N86-21745 California Univ., Los Angeles.
A NEW IMPLEMENTATION OF THE PIPELINE ANALOG-TO-DIGITAL CONVERSION TECHNIQUE Ph.D. Thesis
Mostafa Reza Yazdy 1985 207 p
Avail: Univ. Microfilms Order No. DA8522359

With the present trend towards digital LSI technology, the techniques of analog-to-digital conversion play a major role in the rapidly growing field of signal processing. For over two decades many approaches for A/D conversion have been explored. Among them two popular schemes; successive approximation and flash conversion techniques, are widely used at the present time. An alternative to the methods above, that has the advantages of those techniques without their drawbacks, is the pipelining approach to be described in this dissertation. A new implementation of this technique, which allows for realization of high speed A/D conversion without complex circuitry, is introduced. A discrete prototype of an 8-bit pipeline converter, using commercially available IC's, was built and the experimental results are presented. The circuit realization of the pipeline converter, along with the NMOS and CMOS circuit designs and SPICE simulations of all key components of the A/D (op amps, comparators,...) are provided. These key elements are laid out and fabricated, using 4 microns standard NMOS and 5 microns double-poly p-well bulk CMOS technologies, and the test results are presented. Dissert. Abstr.

N86-21746 Boston Coll., Chestnut Hill, Mass.
THE EFFECT OF CONTACTS ON THE COUNTING CHARACTERISTICS OF HEAVILY DOPED n-TYPE CADMIUM TELLURIDE Ph.D. Thesis
Hai-Yuin Cheng 1985 237 p
Avail: Univ. Microfilms Order No. DA8522305

Cadmium telluride single crystals were grown heavily doped with chloride. The resulting crystals were n-type with free carrier concentrations of the order of 10 to the 12th power cu cm/v-sec and resistivities between .002 and .0002 ohm-cm. Studies were made of the gamma and alpha counting characteristics of these crystals with metal, metal-semiconductor, and metal-insulator electrodes. It was found that the MIS and MSS structures resulted in significant improvement over the MS structures in counting, signal-to-noise and energy resolution. Dissert. Abstr.

N86-21747 Carnegie-Mellon Univ., Pittsburgh, Pa.
GALLIUM ARSENIDE STRUCTURES AND INTERFACES FORMED BY MOLECULAR BEAM EPITAXY Ph.D. Thesis
Hwa Cheng 1985 148 p
Avail: Univ. Microfilms Order No. DA8517515

Sb-GaAs Schottky barrier diodes on n and p clean substrates were prepared by in situ metal deposition in a molecular beam epitaxy (MBE) system. Reduction of effective barrier heights on substrates with higher doping concentrations is in agreement with theoretical predictions. Thermal annealing up to 250 C shows changes in barrier heights that depend on whether the original surface was As or Ga rich. The barrier heights of thick Ga layers on n- and p-type (100) GaAs surfaces are 1.0 eV and 0.44 eV, respectively. The lective epitaxy of GaAs through windows in SiO2 deposited on semi-insulating GaAs substrates was also studied. The epitaxial growth of GaAs sub y Sb sub 1-y (y is equal to or greater than 7) on GaAs for study of the interface region was examined. This facilitates the compositional control in the MBE growth of GaAs (sub y) Sb (sub 1-y) film by adjusting the atomic flux ratio of Sb to Ga with extra arsenic flux supplied for maintaining stoichiometry. Dissert. Abstr.

N86-21748 Stanford Univ., Calif.
PERFORMANCE LIMITS OF SCALED CMOS ANALOG ICs Ph.D. Thesis
Jamebond Kuo 1985 138 p
Avail: Univ. Microfilms Order No. DA8522181

A new concept of merging semi-custom CMOS analog circuits with the basic digital gate array approach is introduced with a 2 micron analog/digital gate array chip. Tradeoffs in the analog circuit performance using scaled digital CMOS technology were evaluated. Speed and precision performance limits in scaled CMOS analog integrated circuits based on pass transistor induced errors are investigated. Conventional single lump SPICE models used to analyze transients of MOS transistors assume quasi-static operation, which can easily be violated for high speed analog applications. New distributed and two lump models were created to analyze pass transistor turn-off transients for very short clock fall times. These models can be used to explain performance of transistors in the diffusion mode of operation. A pass transistor test chip including four kinds of new selectively doped pass transistors was designed, fabricated, and tested to verify the transient analysis. Measured transients are consistent with the model results. Dissert. Abstr.

N86-21749 Stanford Univ., Calif.
INTERFACE STRUCTURE AND ELECTRONIC PROPERTIES OF THE TITANIUM-SILICON SYSTEM Ph.D. Thesis
Marc Alan Taubenblatt 1985 237 p
Avail: Univ. Microfilms Order No. DA8522235

Although Schottky barrier diodes and ohmic contacts are used extensively in integrated circuits, no theory currently exists that accurately predicts the electronic properties of the barrier from basic materials parameters. The importance of the metal-silicon interface in determining these properties and the complexity of the reactions observed have made the formulation of such a theory quite difficult. Silicon Schottky barriers were examined by a carefully controlled study of both interface structure and electrical properties for titanium-silicon diodes, which are of interest for use in advanced integrated circuits. An ultra-high vacuum system capable of in situ analysis of interface structure using surface spectroscopies was designed and constructed, and measurement of barrier height was performed using the photoresponse technique. This system provides a well controlled environment, which reduces the confounding effects of uncharacterized contamination, and allows detailed interface studies not otherwise possible. The results impact on both Schottky barrier technology, by elucidating interfacial reactions and correlating them to electrical behavior for relevant systems, and Schottky barrier theory, by determining barrier characteristics that Schottky models must be able to explain. Dissert. Abstr.

N86-21750 Stanford Univ., Calif.
NUMERICAL MODEL AND ANALYSIS OF TRANSISTORS WITH POLYSILICON EMITTERS Ph.D. Thesis
Zhiping Yu 1985 130 p
Avail: Univ. Microfilms Order No. DA8522254

With the advent of Very Large Scale Integration (VLS) technology, innovative bipolar devices with shallow junctions and high performances are being developed both for silicon and compound semiconductor materials. In the composite structure, such as HBJT (Heterojunction Bipolar Junction Transistor), the device characteristics are controlled not only by the doping profile but also by the composition of the structure. A complete physical and numerical model was developed to handle the carrier transport in such composite structure. An analytical approach (the introduction of an effective recombination velocity) to analyze carrier transport in the emitter of the bipolar transistor is discussed. Both analytical and numerical methods are then applied to the analysis of the device characteristics of transistors with polysilicon emitters. Good agreement between simulations and experimental results is achieved, and a regime of carrier distribution in the base space charge region is revealed. The numerical implementation of the model--a general purpose, one dimensional device simulation program (SEDAN) is briefly discussed. Dissert. Abstr.

N86-21751 Oregon Graduate Center for Study and Research, Beaverton.
STRUCTURE AND ELECTRICAL PROPERTIES OF STRONTIUM ZIPCONATE Ph.D. Thesis
Nongluck Pankurddee Suriyayothin 1984 197 p
Avail: Univ. Microfilms Order No. DA8517174

The different defect disorders in ternary ionic crystals of the type ABO3 were considered and defect concentrations as functions of several independent thermodynamic variables were evaluated. This analysis was then applied to interpret the specific case of the electrical behavior of SrZrO3. The analysis was next extended to explain the effects of partially and completely ionized foreign atoms, both acceptors and donors, added intentionally or present as impurities, to achieve controlled properties. Equilibrium conduc-

tivity experiments were performed over a wide range of temperature P sub O2 and dopant concentration and the applicability of point defect chemistry in solving these results was demonstrated. Thermogravimetric studies, under both oxidizing and reducing conditions, were conducted to under the self-compensation phenomenon in SrZrO3 with dopant additions and a model was proposed to explain the compensation process. The underlying mechanisms involved in the conduction process were also directly studied through diffusion experiments, by following the kinetics of interdiffusion through transient electrical conductivity measurements, again over a wide range of temperature and P sub O2 steps. Finally, a comprehensive study was made of laser-excited Raman spectra characteristics of undoped and doped zirconates at various temperatures. Dissert. Abstr.

N86-21752# Defence Research Information Centre, Orpington (England).
LOW LOSS DIELECTRICS WITH CONTROLLABLE VALUES OF SPECIFIC PERMITTIVITY
J. Zehentner Oct. 1985 13 p refs Transl. into ENGLISH from Elektrotechnicky Casopis, vol. 22, no. 1, 1971 p 66-72
(DRIC-T-7632; BR97524) HC A02/MF A01

The preparation of solid phase dielectric materials for filling functional volumes in microwave circuits is discussed. The objective is to produce filling material of known low loss and with a high operating temperature and known temperature coefficient of permittivity. Waxes, polymers, and ceramics are considered. It is concluded that a mixture of one of the polymers with a suitable ceramic is the most likely material. Mixtures of polystyrene and rutile are examined. It is concluded that this combination is the most suitable. Author (ESA)

N86-21753 Plessey Co. Ltd., Havant (England).
THE RTJ1200 VIDEO AMPLIFIER. INVESTIGATION OF LOW NOISE, LOW DISTORTION AMPLIFIERS FOR LOW SOURCE IMPEDANCE
N. Downie Jul. 1983 41 p refs
(Rept-52/83/54) Copyright. Avail: Issuing Activity

Amplifier circuits for a video recorder were studied. Integrated circuit or hybrid modules capable of meeting the noise and harmonic specification are not available. Designs employing discrete transitors and integrated circuits were investigated using specially prepared test equipment. By suitable choice of input transistor and careful circuit design, the required 3dB noise figure can be met. A standard test circuit was employed to prepare a preference list of transistors to aid this choice. The second and third harmonic specifications of < -90dB could not be measured with the test rig. However, figures of < -80dB are observed for these parameters on different amplifiers. The most promising design employs a complementary pair common emitter stage.
Author (ESA)

N86-21754 Marconi Space Systems Ltd., Portsmouth (England).
METEOSAT OPERATIONAL PROGRAMME: RADIOMETER IMAGING ELECTRONICS RADIATION ANALYSIS
K. Morgan May 1985 24 p
(MTO-51F00-031) Copyright. Avail: Issuing Activity

The radiation dosage received by any component within the METEOSAT imaging electronics units are calculated. The effect of the radiation dosage is interpreted. Results show that radiation dosage within the radiometer is extremly low. If it is assumed that the background bremstrahlung level is 15 k rad, the visible and IR preamplifier units receive well below the background radiation level dosage. The total dosage is 43 k rad (si). The effect on components is detailed. Author (ESA)

N86-21755*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRAMMABLE, AUTOMATED TRANSISTOR TEST SYSTEM
Long V. Truong and Gale R. Sundburg 1986 25 p refs Presented at the 3rd Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 13-16 Jan. 1986
(NASA-TP-2554; E-2768; NAS 1.60:2554) Avail: NTIS HC A02/MF A01 CSCL 09A

A programmable, automated transistor test system was built to supply experimental data on new and advanced power semiconductors. The data will be used for analytical models and by engineers in designing space and aircraft electric power systems. A pulsed power technique was used at low duty cycles in a nondestructive test to examine the dynamic switching characteristic curves of power transistors in the 500 to 1000 V, 10 to 100 A range. Data collection, manipulation, storage, and output are operator interactive but are guided and controlled by the system software. Author

N86-21756*# National Aeronautics and Space Administration, Washington, D.C.
SURFACE DISCHARGE THROUGH AN INSULATOR IN A VACUUM
B. Boersch, H. Hamisch, and W. Ehrlich Oct. 1985 26 p refs Transl. into ENGLISH from Zeitschrift fuer Angewandte Physik (West Germany), v. 15, 1963 p 518-524 Presented at the 5th International Electromicroscopy Conference, Philadelphia, Pa., 1962 Transl. by The Corporate Word, Inc., Pittsburgh, Pa. Original doc. prep. by Technische Univ., Berlin, West Germany
(Contract NASw-4006)
(NASA-TM-77936; NAS 1.15:77936) Avail: NTIS HC A03/MF A01 CSCL 09C

A model for the mechanism of stationary discharges over insulators in a vacuum was developed. Upon introduction of this discharge, the insulator charges as a result of secondary emissions, in such a way that electrons coming from the cathode strike with an average secondary electron yield of 1, and so that the secondary electrons return again to the insulator through the electric field near the insulator. When the secondary electrons strike, electrons with an average yield of 1 are released again. The electrons move in short faults toward the anode, which they strike with lesser energy. Author

N86-21757*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICALLY CONTROLLED PHASED ARRAY ANTENNA CONCEPTS USING GaAs MONOLITHIC MICROWAVE INTEGRATED CIRCUITS
Richard R. Kunath and Kul B. Bhasin [1986] 9 p refs To be presented at the Optical Control Techniques Applied to Antennas and Propagation Session of the International IEEE AP-S/URSI Symposium, Philadelphia, Pa., 9-13 Jun. 1986
(NASA-TM-87229; E-2887; NAS 1.15:87229) Avail: NTIS HC A02/MF A01 CSCL 09A

The desire for rapid beam reconfigurability and steering has led to the exploration of new techniques. Optical techniques have been suggested as potential candidates for implementing these needs. Candidates generally fall into one of two areas: those using fiber optic Beam Forming Networks (BFNs) and those using optically processed BFNs. Both techniques utilize GaAs Monolithic Microwave Integrated Circuits (MMICs) in the BFN, but the role of the MMIC for providing phase and amplitude variations is largely eliminated by some new optical processing techniques. This paper discusses these two types of optical BFN designs and provides conceptual designs of both systems. Author

N86-21758# Illinois Univ., Urbana. Applied Computation Theory Group.
AREA-TIME LOWER-BOUND TECHNIQUES WITH APPLICATION TO SORTING
Gianfranco Bilardi and Franco P. Preparata 25 Apr. 1985 42 p
(Contract N00014-84-C-0149)
(AD-A161327; ACT-59; UILU-ENG-85-2217) Avail: NTIS HC A03/MF A01 CSCL 09/5

The area-time complexity of VLSI (Very Large Scale Integration) computations is constrained by the flow and the storage of information in the two-dimensional chip. The information exchanged across the boundary of the cells of a square-tessellation of the layout is considered. When the information exchange is due to the functional dependence between variables respectively input and output on opposite sides of a cell boundary, lower bounds

are obtained on the AT squared measure (which subsume bisection bounds as a special case). When information exchange is due to the storage saturation of the tessellation cells, a new type of lower bound is obtained on the AT measure. In the above arguments, information is essentially viewed as a fluid whose flow is uniquely constrained by the available bandwidth. However, in some computations, the flow is kept below capacity by the necessity to transform information before an output is produced. This mechanism is called computational friction and it is shown that it implies lower bounds on the AT/log A measure. Regimes corresponding to each of the three mechanisms described above can appear by varying the problem parameters. GRA

N86-21759# Illinois Univ., Urbana. Applied Computation Theory Group.
A NETWORK FLOW APPROACH TO THE WAFER SCALE INTEGRATION OF VLSI ARRAYS
Bruno Codenotti and Roberto Tamassia Jun. 1985 16 p
(Contract N00014-84-C-0149)
(AD-A161345; ACT-61; UILU-ENG-85-2222) Avail: NTIS HC A02/MF A01 CSCL 09/5

An algorithm is described for reconfiguring a 2-dimensional VLSI array on a silicon wafer that has some faulty cells. The functional cells of the array are interconnected in order to simulate a fault-free array of smaller size, where the interconnection wires are routed inside horizontal and vertical channels, according to the Manhattan model. The concept of simulation distance is introduced, and it is shown to be related to the length of the longest interconnection wire. The algorithm makes use of network flow techniques in order to find wiring with minimum simulation distance. This results in a practical heuristic for minimum simulation distance. This results in a practical heuristic for minimizing the maximum wire length. The complexity and performance of this algorithm are also discussed in the paper. GRA

N86-21760# Illinois Univ., Urbana. Computer Systems Group.
REDUCING MEMORY REFERENCES VIA EFFECTIVE REGISTER USAGE M.S. Thesis
Hoichi Cheong May 1985 99 p
(Contract N00014-79-C-0424)
(AD-A161352; CSG-41; UILU-ENG-85-2216) Avail: NTIS HC A05/MF A01 CSCL 09/2

In order to better utilize the greater possible number of on-chip registers in VLSI-technology processor chips, the memory access behavior of several programs was traced and analyzed. More registers, properly used, lead to a substantial reduction in the off-chip memory accesses required by a program, thereby resulting in a significant performance speedup. This work concentrates on identifying an effective register allocation policy and exploring the relationship between the number of registers used and the consequent reduction in the number of memory accesses. Several different register allocation strategies have been applied to the trace data. It is shown from this analysis that a great number of the memory accesses produced when executing a program can be eliminated by a small increase over the typical number of registers. A simple, but effective, allocation strategy, which achieves this reduction is to allocate registers to data with short average interaccess distance. GRA

N86-21761# Illinois Univ., Urbana. Coordinated Science Lab.
SWITCH-LEVEL TIMING SIMULATION OF MOS VLSI (METAL-OXIDE-SEMICONDUCTOR VERY LARGE-SCALE INTEGRATED) CIRCUITS Final Technical Report, Aug. 1980 - Dec. 1984
Vasant B. Rao Jan. 1985 246 p
(Contract N00014-84-C-0149)
(AD-A161371; R-1032; IU-UILU-ENG-85-2207) Avail: NTIS HC A11/MF A01 CSCL 09/5

The development of a fast and accurate simulation tool for very-large-scale integrated (VLSI) circuits consisting of metal-oxide-semiconductor (MOS) transistors is described. Such tools are called switch-level timing simulators and they provide adequate information on the performance of the circuits with a reasonable expenditure of computation time even for very large circuits. The algorithms presented in this thesis can handle only n-channel MOS (NMOS) circuits, but are easily extendible to handle complementary MOS(CMOS) circuits as well. The algorithms presented report have been implemented in a computer program called MOSTIM. In all the circuits simulated thus far, MOSTIM provides timing information with an accuracy of within 10% of that provided by SPICE2, at approximately two orders of magnitude faster in simulation speed. Author (GRA)

N86-21762# Naval Postgraduate School, Monterey, Calif. Coordinated Science Lab.
A SIMULATION PROGRAM WITH LATENCY EXPLOITATION AND NODE TEARING M.S. Thesis
Tat Kwan E. Yu Feb. 1985 91 p
(Contract N00014-84-C-0149)
(AD-A161379; R-1029; UILU-ENG-85-2204) Avail: NTIS HC A05/MF A01 CSCL 09/5

Circuit simulation has become an indispensable tool in the design of integrated circuits. Standard circuit simulators, such as SPICE (1), can predict accurately the circuit performance. However, the use of these simulators is limited to circuits of several hundred transistors. As the size and complexity of the integrated circuit increase, the memory and cpu time requirements for such an analysis become prohibitive. GRA

N86-21763# Illinois Univ., Urbana. Coordinated Science Lab.
INVESTIGATION OF PLANAR WAVEGUIDES AND COMPONENTS FOR MILLIMETER-WAVE INTEGRATED CIRCUITS
K. J. Webb and R. Mittra Mar. 1985 87 p
(Contract N00014-84-C-0149)
(AD-A161400; R-1034; IU-UILU-ENG-85-2209) Avail: NTIS HC A05/MF A01 CSCL 09/5

Several important elements in millimeter-wave integrated circuit systems are studied. Filter-type structures which are composed of a series of discontinuities are employed frequently in such systems. The study of the general discontinuity problem is thus very important. GRA

N86-21764# University of Southern California, Los Angeles.
ELECTRICALLY EXCITED PHENOMENA IN GAS-PHASE DEVICES Final Report, 5 Jul. 1982 - 4 Jul. 1985
Martin A. Gundersen 18 Oct. 1985 17 p
(Contract DAAG29-82-K-0137)
(AD-A161527; ARO-19238.16-PH) Avail: NTIS HC A02/MF A01 CSCL 09/1

The research program sought to analyze in a very quantitative way the high current glow discharge for hydrogen, and other gases that are of interest for optogalvanic opening switches, thyratons, and for other areas of high power switching, The work developed quantitative models, and this analysis, based on theory and experiment, provides a body of basic knowledge to be used for switch development and other applications. the program addressed properties of the bulk plasma including transport, the electron distribution function, the populations of specific excited states, and device development. This is needed for the development of a new and different generation of gas phase devices, and thus will be especially useful as device concepts are developed that are based on energy transfer processes involving specific quantum states, such as light assisted opening switches and other optogalvanic devices. Further, the development of optical diagnostic methods will provide an important additional benefit to DOD laboratory research. GRA

N86-21765# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
WAFER-SCALE INTEGRATION OF SYSTOLIC ARRAYS
Frank Thomson Leighton and Charles E. Leiserson Oct. 1985 31 p
(Contract N00014-80-C-0622; Grant AF-AFOSR-0326-82)
(AD-A161528) Avail: NTIS HC A03/MF A01 CSCL 09/5

VLSI technologists are fast developing wafer-scale integration. Rather than partitioning a silicon wafer into chips as is usually done, the idea behind wafer-scale integration is to assemble an

entire system (or network of chips) on a single wafer, thus avoiding the costs and performance loss associated with individual packaging of chips. A major problem with assembling a large system of microprocessors on a single wafer, however, is that some of the processors, or cells, on the wafer are likely to be defective. In the paper, we describe practical procedures for integrating wafer-scale systems around such faults. The procedures are designed to minimize the length of the longest wire in the system, thus minimizing the communication time between cells. Although the underlying network problems are NP-complete, we prove that the procedures are reliable by assuming a probabilistic model of cell failure. We also discuss applications of this work to problems in VSLI layout theory, graph theory, fault-tolerant systems and planar geometry. GRA

N86-21766# Army Combat Systems Test Activity (Provisional), Aberdeen Proving Ground, Md.
DEVELOPMENT OF IMPROVED BROADBAND CABLE SYSTEM COMMUNICATIONS Research Study, May 1983 - Aug. 1985
C. L. Francis Aug. 1985 42 p
(AD-A161559; USACSTA-6272) Avail: NTIS HC A03/MF A01 CSCL 17/2

A broadband cable system was installed at U.S. Army Combat Systems Test Activity (USACSTA) in 1980 to allow data communication between test site data acquisition systems. The high-speed modems selected for this function were found to be unreliable and unmaintainable. This project was to investigate alternative equipment which would be suitable for providing high-speed data communications on the USACSTA broadband cable system. The investigation was conducted at USACSTA from May 1983 to August 1985. It is concluded that: (1) The Fairchild Data Corporation M505 provides the flexibility, reliability, and maintainability required for the USACSTA broadband network; (2) The best network topology consists of using a computer at Building 436 to perform network routing and not using a translator; (3) Routine preventive maintenance must be performed on the broadband cable system to maintain its effectiveness; (4) The CATEL DM-2100 provides adequate low-speed performance; (5) Additional cable drops must be provided to meet user needs; (6) An improved software data transfer utility must be created to support the broadband cable system requirements; (7) The addition of an audio-communications capability to the broadband cable system would increase its utility and improve range communications. Author (GRA)

N86-21767# Illinois Univ., Urbana. Applied Computation Theory Group.
THE AREA-TIME COMPLEXITY OF SORTING M.S. Thesis
Gianfranco Bilardi Dec. 1984 192 p
(Contract N00014-84-C-0149)
(AD-A161562; ACT-52; UILU-ENG-84-2218) Avail: NTIS HC A09/MF A01 CSCL 12/1

This thesis studies the minimum area A = alpha sub n,k (T) required by a layout of a VLSI circuit that sorts n k-bit keys in time T. The square tessellation technique is introduced as a powerful tool to establish area-time lower bounds, based on the information exchanges across the boundary of a suitable set of square cells that tessellate the layout region. When the information exchange is due to the fact that variables output on one side of the cell boundary are functions of variables input on the other side, the square tessellation yields bounds on the AT squared measure. When, on the other hand, the information exchange is due to the fact that the cell saturates its storage resources and sends some information outside for temporary storage, the square tessellation yields bounds on the AT measure. Both AT squared and AT lower bounds are obtained for sorting. The former dominate in fast computations, while the latter dominate in slow computations. The analysis indicates that the nature of the problem varies considerably with the relative size of n and k, and suggest a classification of keys into short (k > or = logn), long (k > or = 2logn), and of medium length . Optimal or near-optimal designs of VLSI sorters are proposed for the entire range of n, k, and T, confirming the inherent validity of the lower-bound analysis. GRA

N86-21768# Michigan Univ., Ann Arbor. Solid-State Electronics Lab.
HARMONIC POWER GENERATION OF IMPATT DIODES Final Report, 15 Mar. 1982 - 30 Sep. 1985
C. K. Pao Sep. 1985 316 p
(Contract DAAG29-82-K-0083)
(AD-A161611; TR-174; ARO-18619.2-EL) Avail: NTIS HC A14/MF A01 CSCL 10/2

The harmonic power generation capability of IMPATT diodes is investigated theoretically and experimentally. The existing computer simulation program for IMPATT diodes, employing the drift-diffusion model, is used to investigate four different conventional double-drift IMPATT diodes operated in the active mode and three pin diodes with different lengths operated in the passive mode and three pin diodes with different lengths operated in the passive mode at a fundamental frequency of 23 GHz. For conventional IMPATT diodes, the depletion-layer modulation effect, which strongly depends on the diode doping structure, is essential for harmonic power generation. Because of the moderate dependence of the harmonic current on the terminal RF voltage, the GaAs and Si uniform diodes seem to be promising devices for harmonic power generation. The GaAs uniform diode can achieve the highest third-harmonic efficiency, of the order of 4.1 percent, while the Si uniform diode can achieve the highest third-harmonic power of the order of 1. GRA

N86-21769# Office of Naval Research, London (England).
QUANTUM ELECTRONICS IN THE UK, A NATIONAL-SURVEY CONFERENCE
Paul Roman 30 Oct. 1985 12 p Conference held in Malvern, England, 16-20 Sep. 1985
(AD-A161623; ONRL-C-11-85) Avail: NTIS HC A02/MF A01 CSCL 09/3

This report on the status of quantum electronics in U.K. highlights presentations on lasers, nonlinear optics, and quantum optics. GRA

N86-21770# Illinois Univ., Urbana. Applied Computation Theory Group.
PLANE REPRESENTATIONS OF GRAPHS AND VISIBILITY BETWEEN PARALLEL SEGMENTS
Roberto Tamassia and Ioannis G. Tollis Apr. 1985 29 p
(Contract N00014-84-C-0149)
(AD-A161689; ACT-57; UILU-ENG-85-2215) Avail: NTIS HC A03/MF A01 CSCL 09/5

Several layout compaction strategies for VLSI are based on the concept of visibility between parallel segments, where we say that two parallel segments of a given set are visible if they can be joined by a segment orthogonal to them, which does not intersect any other segment. This paper studies visibility representations of graphs, which are constructed by mapping vertices to horizontal segments, and edges to vertical segments drawn between visible vertex-segments. Clearly, every graph that admits such a representation must be a planar. The authors consider three types of visibility representations, and give complete characterizations of the classes of graphs that admit them. Furthermore, they present linear time algorithms for testing the existence of and constructing visibility representations of planar graphs. GRA

N86-21771# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
A COHERENT VLSI DESIGN ENVIRONMENT Semiannual Technical Report, 1 Apr. - 30 Sep. 1985
Paul Penfield, Jr., Lance A. Glasser, Thomas F. Knight, Jr., Charles E. Leiserson, and Ronald L. Rivest 30 Sep. 1985 59 p
(Contract N00014-80-C-0622)
(AD-A161743) Avail: NTIS HC A04/MF A01 CSCL 09/5

The research discussed here is described in more detail in several published and unpublished reports cited. The CAD frame

Schema has progressed to the point where it is useful for ample chip designs. The interface to CIF is complete, and work has begun on importing layout libraries. An interface to EDIF is being installed. Simulators can now be connected, and thought is going into organization of VLSI libraries. A plan for the distribution of Schema is now being worked out. Previous results on waveform bounding have been generalized to large classes of problems described in canonical control-theory form. Work has begun on models for interconnect taking account of line inductance. This domain is less general than RLC networks, and there is hope that some of the previously derived bounds still apply. During this period a novel device, the UV write-enabled PROM, was reported at a conference. Work continues on developing useful circuits employing this device. GRA

N86-21772# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
INVESTIGATION OF SHEATH PHENOMENA IN ELECTRONEGATIVE GLOW DISCHARGES Final Report, Jul. 1980 - Sep. 1984
Gary L. Duke Apr. 1985 230 p
(AF Proj. 230-1)
(AD-A162416; AFWAL-TR-84-2099) Avail: NTIS HC A11/MF A01 CSCL 20/3

Two different methods of analyzing the cathode fall region of low pressure glow discharges were developed and applied to three different electronegative gas mixtures. One method was based on a self-consistent numerical solution to Poisson's equation, the current continuity equations for electrons and negative ions, and the current conservation equation. This method assumes the electrons are always in equilibrium with the electric field. The other method was based on a self-consistent numerical solution of the Boltzmann transport equation for electrons, Poisson's equation, and the current conservation equation. This method allows the electrons not to be in equilibrium with the field. Comparing these two methods revealed that nonequilibrium prevails throughout the cathode fall region. The electronegative gas mixtures investigated were small concentrations (less that 10%) of hydrogen chloride in helium, argon, or xenon. The electric field, Townsend ionization and attachment coefficients, electron and negative ion current densities, and electron, positive ion, and negative ion number densities are plotted as functions of distance through the cathode fall region. GRA

N86-21773# Georgia Univ., Athens. Dept. of Physics and Astronomy.
TIME AND FREQUENCY DEPENDENT BEHAVIOR OF A TWO DIMENSIONAL ELECTRON GAS AT LONG WAVELENGTHS
M. H. Lee and J. Hong 5 Nov. 1985 35 p
(Contract N00014-84-K-0365)
(AD-A162546; TR-10) Avail: NTIS HC A03/MF A01 CSCL 09/3

Using the recently developed method of recurrence relations, we have studied the time and frequency dependent behavior of the two dimensional electronic system at long wavelengths. Several families of autocorrelation functions including the relaxation and memory functions are obtained exactly. In addition, other linear response quantities e.g., the density-density response function and dynamic structure factor are obtained. This work contains a detailed application of the method of recurrence relations. GRA

N86-21774# Illinois Univ., Urbana. Coordinated Science Lab.
SILICON COMPILATION: A SOLUTION TO THE COMPLEXITY OF VLSI (VERY LARGE-SCALE INTEGRATED) CIRCUIT DESIGN M.S. Thesis. Final Technical Report, Sep. 1984 - Sep. 1985
Perry Gee Sep. 1985 72 p
(Contract N00014-84-C-0149)
(AD-A162564; UILU-ENG-85-2230) Avail: NTIS HC A04/MF A01 CSCL 09/5

Designing very large-scale integrated circuits requires several months or more and increases as the complexity of the design increases. This thesis proposes to reduce the complexity of the design problem and to reduce the design time by using a high-level language to specify only the behavioral aspects of a circuit. The circuit is then synthesized from this specification. GRA

N86-21775# Washington Univ., Seattle. Dept. of Computer Science.
AUTOMATED GENERATION OF MICROCONTROLLERS Interim Technical Report
Barry W. Jinks, David L. Pulfrey, and Warren S. Snyder Dec. 1985 5 p
(Contract MDA903-85-K-0072; ARPA Order 4563)
(AD-A162668; TR-85-12-02) Avail: NTIS HC A02/MF A01 CSCL 17/2

The concept of an algorithmic microcontroller has been investigated. Software has been created which, when supplied with design parametrics, will generate several representation of the desire instance. This paper discusses the methodology followed during generator creation and the architecture and instruction set of the resulting family of controllers. A design environment for the automatic generation of microcontrollers in single chip telecommunications applications has been developed. When the input parameters are supplied, the generator synthesizes the mask geometries for the required microcontroller. By analyzing the instructions used in a particular program, layouts of major components such as the ALU and the barrel shifter are defined. In this manner, a compact layout is produced for each different microcontroller instance. Several microcontrollers with data-paths ranging from 2 to 16 bits have been simulated. The corresponding machine cycle times are predicted to be 180 to 600 nanoseconds. GRA

N86-21776# Puerto Rico Univ., Rio Piedras. Dept. of Physics.
A SOLVABLE MODEL FOR LOCALIZED ADSORPTION IN A COULOMB SYSTEM Interim Technical Report
M. L. Rosinberg, J. L. Lebowitz, and L. Blum 15 Oct. 1985 29 p
(Contract N00014-81-C-0776)
(AD-A162697; TR-18) Avail: NTIS HC A03/MF A01 CSCL 11/1

A model for an interface with localized adsorption is presented, in which the surface has a distribution of sticky adhesive sites in contact with a Coulomb fluid. Contrary to the current literature on the electrical double layer the surface charge is in dynamic equilibrium with the bulk fluid. The sum-rules obeyed by the one-and two-body correlation functions are investigated. Explicit results are obtained for a solvable model, the two dimensional one-component plasma at reduced temperature 2. The effect of the granularity of the adsorbed charge on the adsorption isotherm is discussed. GRA

N86-21777# Harry Diamond Labs., Adelphi, Md.
EMPIRICAL EQUATIONS FOR DRIFT VELOCITIES IN SILICON
Alford L. Ward Oct. 1985 18 p
(DA Proj. 1L2-63749-D-462)
(AD-A162743; HDL-TM-85-9) Avail: NTIS HC A02/MF A01 CSCL 20/12

Hardening against the electromagnetic pulse and high power microwave radiation is discussed. Vital to semiconductor modeling of burnout are the transport properties of semiconductors at high fields and high temperatures. At present, there is no single expression valid for this hot electron regime. The results of this study will be used in the thermal modification of the DIODE2D program, now underway. A recent report of the National Reseach Council, Evaluation of Methodologies for Estimating Vulnerability to Electromagnetic Pulse Effects, recommended that there should be a better understanding of the mechanisms of component failure. The theoretical work included in this report provides physical insight into the damage mechanisms and should lead to nondestructive means of characterizing specific devices. Empirical equations for the drift velocities of electron and holes in silicon are given as a function of electric field, temperature, and doping density. A single equation, which is valid above room temperature, results from the inverse dependence of the saturation velocity upon the square root of the temperature. GRA

N86-21778# Graz Univ. (Austria).
PROJECT: SUBMICRON PHONONICS 1. 1. THE PROBLEMATICS OF PHONON DISTURBANCES IN d.c. SEMICONDUCTOR TRANSPORT Final Report
P. Kocevar Oct. 1985 6 p
(Contract DAJA45-84-M-0394)
(AD-A162785) Avail: NTIS HC A02/MF A01 CSCL 20/12

The main objectives of the present project were: to develop a FORTRAN-code for distribution functions of nonequilibrium phonons to be used on heated displaced maxwellian (HDM) models of nonlinear transport in GaAs-devices, with the purpose to provide semi-quantitative calculations of nonequilibrium phonon effects on the electronic properties of small devices; to determine the magnitude of such effects on the electronic properties of small devices; to determine the magnitude of such effects; and to determine feasibility and value of a major effort to integrate highly accurate phonon-electron effects into a more precise electron-transport code. GRA

N86-21779# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
EFFECTS OF ESTIMATED NOISE COVARIANCE MATRIX IN OPTIMAL SIGNAL DETECTION
C. G. Khatri and C. R. Rao Oct. 1985 26 p
(Contract F49620-85-C-0008)
(AD-A162796; TR-85-38; AFOSR-85-1130TR) Avail: NTIS HC A03/MF A01 CSCL 09/4

There is loss of efficiency when an estimated noise covariance matrix is used in the place of the unknown true noise covariance matrix in the construction of the optimum filter for signal detection. In the case of detecting a single signal specified by a real or a complex vector, we investigate the extent of this loss by obtaining an exact confidence bound for the realized signal to noise ratio. We also give an estimate of this ratio which is useful in optimum selection of features. Some of these results are extended to the case of discrimination between a number of given signals. Author (GRA)

N86-21780# Department of the Army, Washington, D. C.
OPTICALLY TRIGGERED BULK DEVICE GUNN OSCILLATOR Patent Application
Lawrence J. Bovino and Maurice Weiner, inventors (to Army) Filed 28 Oct. 1985 94 p
(AD-D011977; US-Patent-Appl-SN-791672) Avail: NTIS HC A05/MF A01 CSCL 09/5

A high power solid state source of microwave and millimeter wave signals is provided by an optically triggered body of bulk semiconductor material selected from the Group 3 to 5 compounds including GaAs, Cr:GaAs, and Fe:InP and having a relatively long gap length which is in the order of 0.5 to 10.0 mm as well as having a resistivity which is greater than 10 to the 7th power ohm-cm. The device is further dc biased to a field of between 15 kV/cm and 35 kV/cm. Under such conditions, a very low dc current flows without any oscillatory behavior; however, illumination of the semiconductor body with a fast rising optical pulse having a wavelength suitable for carrier generation causes electrons to be lifted to the conduction band which is accompanied by a rapid reduction of the resistivity. At the same time, the electric field across the gap length decreases to a value just above the oscillation threshold whereupon high power RF oscillations are generated whose frequency is a function of the recombination time of the excited carriers. Author (GRA)

N86-21781# Department of the Air Force, Washington, D.C.
ELECTRICAL CONE CONNECTOR Patent Application
Edward A. Strate, inventor (to Air Force) Filed 9 Oct. 1985 20 p
(AD-D011982; US-Patent-Appl-SN-785690) Avail: NTIS HC A02/MF A01 CSCL 09/1

The electrical interface of two sets of wires is accomplished with the use of a conically shaped male plug, a female socket, an indexing key and a self locking center bolt. The male plug terminates a first set of wires in a plurality of contacts on its conically shaped mating surface. The female socket terminates a second set of wires in a concave conical surface which is complementary to the mating surface of male plug. The self locking center bolt is inserted through the female socket into an insert within the male plug, and provides a means for early engagement and locking between the male plug and female socket that prevents contacts from prematurely making and contact. The indexing key is a longitudinal protrusion on the female socket which fits into a complementary slot on the male plug to align the contacts of the first and second set of wires to ensure a proper connection between the two set of wires. GRA

N86-21782# Department of the Air Force, Washington, D.C.
CLAW GRIP CONTACT PROBE FOR FLAT PACKS Patent Application
Joseph W. Shearer, Jr., inventor (to Air Force) Filed 24 Sep. 1985 19 p
(AD-D011997; US-Patent-Appl-SN-779402) Avail: NTIS HC A02/MF A01 CSCL 09/1

A probe device including a unitary body 2 and a sliding plate means 44 for testing and diagnosing multi-lead electrical flat packs. The sliding plate means contains two sets of holes 52 into which are inserted spring-loaded electrical contact probes for making contact with the leads of the electrical flat pack. The unitary body 2 includes comb teeth for orienting the unitary body over the leads of the electrical flat pack, as well as gripping means having hook ends for securely fastening the probe device to the electrical flat pack being tested or diagnosed. The gripping means include an outwardly flared portion against which the sliding plate means exerts inward lateral pressure causing the hook ends to grip underneath the electrical flat pack at each corner thereof to securely clamp it in place. Included in unitary body 2 is at least one threaded hole which is sufficiently large to allow a size 4 to 40 machine screw to pass therethrough. Author (GRA)

N86-21783# Lawrence Livermore National Lab., Calif.
ELECTRICAL CONDUCTIVITY MEASUREMENTS IN SHOCK COMPRESSED LIQUID NITROGEN
D. C. Hamilton, A. C. Mitchell, and W. J. Nellis Jun. 1985 6 p refs Presented at the American Physical Society Topical Conference on Shock Waves in Condensed Matter, Spokane, Wash., 22 Jul. 1985
(Contract W-7405-eng-48)
(DE86-001575; UCRL-93396; CONF-850736-64) Avail: NTIS HC A02/MF A01

The electrical conductivity of shock compressed liquid nitrogen was measured in the pressure range 20 to 50 GPa using a two-stage light-gas gun. The conductivities covered a range 4 x 10(-2) to 1 x 10(2) ohm(-1) cm(-1). The data are discussed in terms of a liquid semiconductor model below the onset of the dissociative phase transition at 30 GPa. DOE

N86-21784# Sandia National Labs., Albuquerque, N. Mex.
CHEMICAL PREPARATION OF HIGH-FIELD ZINC OXIDE VARISTORS
R. G. Dosch and K. M. Kimball Sep. 1985 97 p
(Contract DE-AC04-76DP-00789)
(DE86-001611; SAND-85-0195) Avail: NTIS HC A05/MF A01

Chemical preparation methods were developed for high-field ZnO varistors in which precipitation techniques were used to prepare precursor powders. Varistors were made by sintering uniaxially pressed pellets in the range of 675 to 740 C in air. Varistor properties included electric fields(E) in the 10 to 100 kV/cm range at current densities(J) of 5A/cm(2), nonlinearity coefficients ((ALPHA)) greater than 30 at 2.5 less than or equal to J less than or equal to 5.0 A/cm(2), and densities in the range of 65 to 99% of theoretical depending both on sintering temperature and composition. DOE

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-21785 California Inst. of Tech., Pasadena.
EXPERIMENTAL STUDY OF SHEAR FLOWS AND CONVECTIVE HEAT TRANSFER CHARACTERISTICS OF GRANULAR MATERIALS Ph.D. Thesis
James Scott Patton 1985 180 p
Avail: Univ. Microfilms Order No. DA8522630

Granular material shear flows and convective heat transfer characteristics are presented. The experiments were conducted with two sizes of glass beads. The experiments were conducted with two sizes of glass beads. Information was obtained on the shear stress of polyethylene pellets. Bulk flow properties are used to evaluate wall shear. Development of a method for determining bulk density allowed for more accurate calculation of flow quantities. A derivation of a compressible open channel equation is given for determining the wall shear. Results show that the friction coefficient is not a constant but increases with the Froude Number. The presentation of the wall shear as a function of a wide range of solid fractions is the first experimental work that can be directly compared to analytical and computational investigations. The convective heat transfer properties of flowing granular materials were investigated by examining the flow over a flat heating plate. A derivation for convective heat transfer to flowing granular material is given to predict the heat transfer properties over a wide range of flow conditions. Dissert. Abstr.

N86-21786 California Inst. of Tech., Pasadena.
AN EXPERIMENTAL STUDY OF CONVECTIVE HEAT TRANSFER, FRICTION, AND RHEOLOGY FOR NON-NEWTONIAN FLUIDS: POLYMER SOLUTIONS, SUSPENSIONS OF FIBERS, AND SUSPENSIONS OF PARTICULATES Ph.D. Thesis
Eric Francois Matthys 1985 426 p
Avail: Univ. Microfilms Order No. DA8522628

The convective heat transfer, friction, and rheological properties of various types of nonNewtonian fluid in circular tube flows were investigated. If an apparent Reynolds number is used and if the temperature and degradation effects are properly taken into account, the reduced turbulent friction and heat transfer results, respectively, are then shown to be well correlated by the same expressions for different fluids, regardless of the nature of the fluids and whether they are shear-thinning or shear-thickening. This representation can also separate the reductions in turbulent heat transfer and friction that are induced by viscoelasticity from those induced by pseudoplasticity. Polyacrylamide solutions inducing asymptotic and intermediate drag reduction regimes were investigated over a broad range of Reynolds numbers. A kerosene-based antimisting polymer solution was also studied. Suspensions of bentonite of various concentrations were investigated in laminar and turbulent regimes, and the results for fully developed and entrance flows were well correlated by Newtonian relationships when an adequate wall viscosity concept was used. Dissert. Abstr.

N86-21787 Northwestern Univ., Evanston, Ill.
DYNAMICS AND STABILITY OF FLOWS WITH MOVING CONTACT LINES Ph.D. Thesis
Gerald Wayne Young 1985 317 p
Avail: Univ. Microfilms Order No. DA8523610

The intersection of the interfacial region between two immiscible fluid phases with a solid surface forms a three phase region. Under the continuum hypothesis this three phase region is replaced by a contact line. This property of a contact line along with its other properties is formulated into boundary conditions necessary for the development of well-posed mathematical models governing systems possessing contact lines. Two fluid/fluid/solid systems possessing contact lines are considered. A three-dimensional rivulet flowing down a vertical plane is examined. There exists a basic state with fully developed flow and straight contact lines. In the absence of contact-angle hysteresis the slope of the contact angle versus contact-line speed relationship measures the mobility of these contact lines. The stability characteristics of flat rivulets subject to long wave disturbances are examined using lubrication theory. This research also considers the effects of contact-angle hysteresis on the motion if the contact line formed as a plate is immersed/emerged into and out of a bath of liquid. Wilhelmy plate experiments leading to the measurement of dynamic contact-angle characteristics are based upon such an apparatus. Dissert. Abstr.

N86-21788 California Inst. of Tech., Pasadena.
HEAT RELEASE EFFECTS IN A TURBULENT, REACTING SHEAR LAYER Ph.D. Thesis
James Carl Hermanson 1985 208 p
Avail: Univ. Microfilms Order No. DA8522619

The effects of heat release were studied in a planar, gaseous reacting mixing layer formed between free streams containing hydrogen and fluorine in inert diluents. Sufficiently high concentrations of reactants were employed to produce adiabatic flame temperature rises up to 940 K (1240 K absolute). The Reynolds number at the measuring station, based on velocity difference, 1% temperature thickness and cold kinematic viscosity was approximately 6 x 10 to the 4th power. The temperature field was measured with cold wire resistance thermometers and thermocouples. Flow visualization was accomplished by schlieren spark and motion picture photography. Mean velocity information was extracted from mean pitot probe dynamic pressure measurements. Though the displacement thickness of the layer, for zero streamwise pressure gradient, increased with increasing heat release, the actual growth rate of the layer did not increase, but instead decreased slightly. The mean temperature rise profiles, normalized by the adiabatic flame temperature rise, were not greatly changed in shape by heat release. The change in layer growth rate can be related to change in free stream velocity ratio induced by pressure gradient. Dissert. Abstr.

N86-21789*# National Aeronautics and Space Administration, Washington, D.C.
NUMERICAL SIMULATION OF VORTEX BREAKDOWN
Xungang Shi Nov. 1985 17 p refs Transl. into ENGLISH from Acta Aerodynamica Sinica (Beijing, China), no. 1, 1985 p 22-29 Previously announced in IAA as A85-35785 Transl. by SCITRAN, Inc., Santa Barbara, Calif. Original doc. was prep. by Beijing Univ., China
(Contract NASw-4004)
(NASA-TM-77951; NAS 1.15:77951) Avail: NTIS HC A02/MF A01 CSCL 20D

The breakdown of an isolated axisymmetric vortex embedded in an unbounded uniform flow is examined by numerical integration of the complete Navier-Stokes equations for unsteady axisymmetric flow. Results show that if the vortex strength is small, the solution approaches a steady flow and the vortex is stable. If the strength is large enough, the solution remains unsteady and a recirculating zone will appear near the axis, its form and internal structure resembling those of the axisymmetric breakdown bubbles with multi-cells observed by Faler and Leibovich (1978). For appproprite combinations of flow parameters, the flow reveals quasi-periodicity. Parallel calculations with the quasi-cylindrical approximation indicate that so far as predicting of breakdown is concerned, its results coincide quite well with the results mentioned above. Both show that the vortex breakdown has little concern with the Reynolds number or with the critical classification of the upstream flow, at least for the lower range of Reynolds numbers. Author

N86-21790*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT OF HEAT-TRANSFER COEFFICIENTS IN SHOCK WAVE-TURBULENT BOUNDARY LAYER INTERACTION REGIONS WITH A MULTI-LAYERED THIN FILM HEAT TRANSFER GAUGE

Masanori Hayashi, Akira Sakurai, and Shigeru Aso Jan. 1986 16 p refs Transl. into ENGLISH from Memoirs of the Faculty of Engineering of Kyushu Univ. Technology Reports (Japan), v. 57, Aug. 1984 p 455-462 Original language document was announced in IAA as A85-20997 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77958; NAS 1.15:77958) Avail: NTIS HC A02/MF A01 CSCL 20D

A thin film heat transfer gauge is applied to the measurement of heat transfer coefficients in the interaction regions of incident shock waves and fully developed turbulent boundary layers. It was developed to measure heat flux with high spatial resolution and fast response for wind tunnels with long flow duration. To measure the heat transfer coefficients in the interaction region in detail, experiments were performed under the conditions of Mach number = 4, total pressure = 1.2 MPa, 0.59 to approximately 0.65. Reynolds number = 1.3 to approximately 1.5 x 10 to the 7th power and incident shock angles from 17.8 to 22.8 degrees. The results show that the heat transfer coefficient changes complicatedly in the interaction region. At the beginning the interaction region, the heat transfer coefficient decreases at first, reaches its minimum value at the point where the pressure begins to increase, and then increases sharply. When the boundary layer begins to separate, even a small separation bubble causes significant changes in the heat transfer coefficient, while the pressure does not show any changes which suggests that the boundary layer begins to separate. Author

N86-21791*# National Aeronautics and Space Administration, Washington, D.C.
HEAT AND MASS TRANSFER IN A DISSOCIATED LAMINAR BOUNDARY LAYER OF AIR WITH CONSIDERATION OF THE FINITE RATE OF CHEMICAL REACTION
A. O. Oyegbesan and J. Algermissen Feb. 1986 14 p refs Transl. into ENGLISH from Teplomassoobmen v Dissotsiirovannom Laminarnom Pogranichnom Sloye Vozdukha s Uchetom Konechnoy Skorosti Khimicheskikh Reaktsiy (USSR), v. 2 p 126-137 Presented at the Heat and Mass Transfer 5th, All-Union Conference, Minsk, Belorussian SSSR (USSR), 17-20 May 1976 Original language document was announced in IAA as A77-43939 Transl. by The Corporate Word, Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-78001; NAS 1.15:78001) Avail: NTIS HC A02/MF A01 CSCL 20D

A numerical investigation of heat and mass transfer in a dissociated laminar boundary layer of air on an isothermal flat plate is carried out for different degrees of cooling of the wall. A finite-difference chemical model is used to study elementary reactions involving NO2 and N2O. The analysis is based on equations of continuity, momentum, energy, conservation and state for the two-dimensional viscous flow of a reacting multicomponent mixtures. Attention is given to the effects of both catalyticity and noncatalyticity of the wall. Author

N86-21792*# National Aeronautics and Space Administration, Washington, D.C.
STUDIES OF ACOUSTIC EFFECTS ON A FLOW BOUNDARY LAYER IN AIR
F. Mechel and W. Schilz Feb. 1986 17 p refs Transl. into ENGLISH from Untersuscungen zur Akustischen Beeinflussung der Stroemungsgrenzschicht in Luft (West Germany), Acustica, v. 14, 1964 p 325-331 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Goettingen Univ.
(Contracts NASw-4005; AF61(052)-666)
(NASA-TM-77981; ; NAS 1.15:77981) Avail: NTIS HC A02/MF A01 CSCL 20D

Effects of sound fields on the flow boundary layer on a flat plate subjected to a parallel flow are studied. The boundary layer is influenced by controlling the stagnation point flow at the front edge of the plate. Depending on the Reynolds number and sound frequency, excitation or suppression of turbulent is observed. Measurements were taken at wind velocities between 10 and 30 m/sec and sound frequencies between 0.2 and 3.0 kHz. Author

N86-21793*# National Aeronautics and Space Administration, Washington, D.C.
DEVELOPMENT OF PERTURBATIONS IN THE BOUNDARY LAYER
A. V. Dovgal, Yu. S. Kachanov, V. V. Kozlov, V. Ya. Levchenko, and V. P. Maksimov Feb. 1986 22 p refs Transl. into ENGLISH from the book "Razvitiye Vozmushcheniy v Pogranchnom Sloye" Novosibirsk, USSR, 1979 p 4-22 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77986; NAS 1.15:77986) Avail: NTIS HC A02/MF A01 CSCL 20D

The transition of laminar flows into turbulent flows in a boundary layer is discussed. The individual aspects of the transition process, observed under controllable model conditions are examined. The aspect of this problem, namely the development or excitation of the natural oscillations in the boundary layer, the so-called Tollmin-Schlichting waves is covered. Three types of excitation of these waves are considered: (1) distributed generation throughout the boundary layer; (2) generation in the vicinity of the forward edge of a model, having either a sharp edge or an edge with a large radius or curvature, and (3) generation in a developed boundary layer by means of a focused effect. Author

N86-21794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF A ROTOR WAKE ON THE LOCAL HEAT TRANSFER ON THE FORWARD HALF OF A CIRCULAR CYLINDER
Kim A. Morehouse and Robert J. Simoneu Mar. 1986 22 p refs Presented at the 8th International Heat Transfer Conference, San Francisco, Calif., 17-22 Aug. 1986
(NASA-TM-87234; E-2751; NAS 1.15:87234) Avail: NTIS HC A02/MF A01 CSCL 20D

Turbine rotor-stator wake dynamics was simulated by a spoked wheel rotating in annular flow, generating rotor wakes. Spanwise averaged circumferentially local heat transfer in the circular cylindrical leading edge region of a turbine airfoil was obtained. Reynolds numbers ranged from 35,000 to 175,000. Strouhal numbers ranged from 0.63 to 2.50. Wakes were generated by 2 sets of circular cylindrical bars, 1.59 and 3.18 mm in diameter. The rotor could be rotated either clockwise or counterclockwise. Grid turbulence was introduced upstream yielding freestream turbulence of 1.0 to 2.5% at the stator. Data represented an extensive body of local heat transfer coefficients, which can be used to model the leading edge region of a turbine airfoil. In the presence of rotor wakes, an asymmetry from the leeward to windward side was noted. Windward side levels were 30 to 40% higher than the corresponding leeward side. Author

N86-21795*# National Aeronautics and Space Administration, Washington, D.C.
SEMIEMPIRICAL METHODS FOR COMPUTING TURBULENT FLOWS
I. A. Belov and I. P. Ginzburg Jan. 1986 22 p refs Transl. into ENGLISH from Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia (USSR), no. 1, Jan. 1975 p 159-170 Original language document was announced in IAA as A75-30714 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77996; NAS 1.15:77996) Avail: NTIS HC A02/MF A01 CSCL 20D

Two semiempirical theories which provide a basis for determining the turbulent friction and heat exchange near a wall are presented: (1) the Prandtl-Karman theory, and (2) the theory utilizing an equation for the energy of turbulent pulsations. A comparison is made between exact numerical methods and approximate integral methods for computing the turbulent boundary layers in the presence of pressure, blowing, or suction gradients. Using the turbulent flow around a plate as an example, it is shown that, when computing turbulent flows with external turbulence, it is

preferable to construct a turbulence model based on the equation for energy of turbulent pulsations. Author

N86-21796*# National Aeronautics and Space Administration, Washington, D.C.
LAMINAR BOUNDARY LAYER IN CONDITIONS OF NATURAL TRANSITION TO TURBULENT FLOW
N. F. Polyakov Feb. 1986 43 p refs Transl. into ENGLISH of "Laminarnyy Pogranichnyy Sloy v Usloviyakh Yestestvennogo Perekhoda k Turbulentnomu Techeniyu" rept. Institute of Theoretical and Applied Mechanics, Siberian Section, Academy of Sciences (USSR), Novosibirsk, USSR, 1979 p 23-67 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77985; NAS 1.15:77985) Avail: NTIS HC A03/MF A01 CSCL 20D

Results of experimental study of regularities of a natural transition of a laminar boundary layer to a turbulent layer at low subsonic air flow velocities are presented, analyzed and compared with theory and model experiments. Author

N86-21797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PIEZOVISCOUS EFFECTS IN NONCONFORMAL CONTACTS LUBRICATED HYDRODYNAMICALLY
Yeau-Ren Jeng, Bernard J. Hamrock, and David E. Brewe (Army Aviation Research and Technology Activity-AVSCOM, Lewis Research Center, Cleveland, Ohio) May 1985 36 p refs Presented at the Annual Meeting of the American Society of Lubrication Engineers, Las Vegas, Nev., 5-9 May 1985
(NASA-TM-87141; E-2767; NAS 1.15:87141; USAAVSCOM-TR-86-C-1) Avail: NTIS HC A03/MF A01 CSCL 20D

The analysis is concerned with the piezoviscous-rigid regime of lubrication for the general case of elliptical contacts. In this regime several formulas of the lubricant film thickness have been proposed by Hamrock and Dowson, by Dowson et al., and more recently by Houpert. However, either they do not include the load parameter W, which has a strong effect on film thickness, or they overestimate the film thickness by using the Barus formula for pressure-viscosity characteristics. The Roelands formula was used for the pressure-viscosity relationship. The effects of the dimensionless load, speed, and materials parameters, the radius ratio, and the lubricant entrainment direction were investigated. The dimensionless load parameter was varied over a range of one order of magnitude. The dimensionless speed parameter was varied by 5.6 times the lowest value. Conditions corresponding to the use of solid materials of steel, bronze, and silicon nitride and lubricants of paraffinic and naphthenic mineral oil were considered in obtaining the exponent in the dimensionless materials parameter. The radius ratio was varied from 0.2 to 64 (a configuration approaching a line contact). Forty-one cases were used in obtaining a minimum film thickness formula. Contour plots indicate in detail the pressure developed between the contacting solids. Author

N86-21798*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
RADIATIVE INTERACTIONS IN TRANSIENT ENERGY TRANSFER IN GASEOUS SYSTEMS Progress Report
Surendra N. Tiwari Dec. 1985 103 p refs
(Grant NAG1-423)
(NASA-CR-176644; NAS 1.26:176644) Avail: NTIS HC A06/MF A01 CSCL 20D

Analyses and numerical procedures are presented to investigate the radiative interactions in transient energy transfer processes in gaseous systems. The nongray radiative formulations are based on the wide-band model correlations for molecular absorption. Various relations for the radiative flux are developed; these are useful for different flow conditions and physical problems. Specific plans for obtaining extensive results for different cases are presented. The methods presented in this study can be extended easily to investigate the radiative interactions in realistic flows of hydrogen-air species in the scramjet engine. GRA

N86-21799# Illinois Inst. of Tech., Chicago.
BIFURCATION AND STABILITY OF COMPLEX FLOWS Final Report, 15 Feb. 1982 - 14 Aug. 1985
S. Rosenblat 10 Oct. 1985 8 p
(Contract DAAG29-82-K-0061)
(AD-A161405; ARO-18844.6-MA) Avail: NTIS HC A02/MF A01 CSCL 20/4

The work performed under this Contract was principally concerned with the theoretical investigation of bifurcation and stability phenomena in complex fluid flows. A major part of the effort was devoted to the study of viscoelastic fluids, with special emphasis on the problems concerned with convective instabilities. Both model systems and fluid governing equations were investigated. The dependence of predicted behavior on constitutive relations became very clear. Other convection-type problems considered included coupled thermal loops and convection pattern in the presence of a melting-freezing interface. GRA

N86-21800# Materials Research Labs., Ascot Vale (Australia).
BURGER'S EQUATION AND SHOCK WAVES PROPAGATING WITHIN LIQUID-GAS MIXTURES
E. H. van Leeuwen Aug. 1985 20 p
(AD-A161554; MRL-R-970) Avail: NTIS HC A02/MF A01 CSCL 20/4

In this paper the time evolution of weak shock waves propagating within a fluid-gas mixture is considered. The model uses continuum classical theory to describe the shock waves and allows for the relative motion of the gas bubbles and liquid. It is shown that for a dissipative system the waves are governed by Burger's Equation. This corresponds to the far-field solution for waves of small amplitude and long wavelength. The model also provides a nonlinear description of how the compression wave forms and approaches a steady state. GRA

N86-21801# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAGRANGIAN BOUNDARY EQUATION AND UNSTEADY SEPARATION OF ELLIPTICAL CYLINDER AT ANGLE OF ATTACK
Yunming Chen 15 Nov. 1985 22 p Transl. into ENGLISH from Shuxue Xuebao (China), v. 6, no. 11, 1983 p 571-578
(AD-A162407; FTD-ID(RS)T-0634-85) Avail: NTIS HC A02/MF A01 CSCL 20/4

In this document the Lagrangian boundary equation is introduced to steady the separation of an abruptly moved elliptical cylinder at the angle of attack. Not only the occurrence of separation singular points but also their forward movement with time were calculated. The computation also revealed that the separation pattern would change from trailing edge separation to leading edge separation. In regard to the methodology of computation, a transformation was introduced to map the non-uniform mesh on the physical plane) to the uniform mesh on an auxiliary plane. Thus, it is only required to tighten the mesh (locally on the physical plane to improve the accuracy without increasing too much computing time. In addition, the advantages of the equal space finite difference, such as simplicity and high accuracy, will remain. Furthermore, a complicated variable boundary problem (separation point moving forward) was treated as a fixed boundary problem which significantly simplifies the process. Author (GRA)

N86-21802# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
A DIFFUSER HEAT TRANSFER AND EROSION CODE Final Report, Oct. 1983 - Jul. 1985
Gale H. Buzzard Oct. 1985 54 p
(AD-A162436; AFRPL-TR-076) Avail: NTIS HC A04/MF A01 CSCL 20/13

A computer code for diffuser heat transfer and erosion analysis (DHTE) has been developed which improves upon the earlier Rocket Engine Diffuser Thermal Analysis Program (REDTAP). Improvements contained within DHTE include provision for a radial temperature gradient within the diffuser wall, an improved model for the particle impingement accommodation coefficient, a model

for particle debris shielding, and a model for wall erosion by particle impact. DHTE differs from an earlier diffuser heat transfer code (DHT) to the extent that it incorporates a simple erosion model and utilizes a more recent diffuser version of the JANNAF Standardized Plume Flow Field Model (SCP2ND). The 77-inch diffuser was instrumented to record the water side wall temperature and water jacket temperature at selected sites along the initial seven feet of the diffuser during routine test firings. Data is presented that supports the predictions of DHTE but is inadequate to validate the code. GRA

N86-21803# Defence Research Establishment Suffield, Ralston (Alberta).
THE INFLUENCE OF INITIAL AND BOUNDARY CONDITIONS ON GASEOUS DETONATION WAVES Ph.D. Thesis
Stephen B. Murray Sep. 1985 315 p
(AD-A162631; DRES-SR-411) Avail: NTIS HC A14/MF A01 CSCL 19/4

Results of five experimental investigations on the initiation, propagation and transmission of detonation have shown that the wave behavior depends on the relative rates of gasdynamic expansion and chemical energy release occurring within the cellular detonation front. The former rate is controlled by the boundary conditions defined by the physical system, while the latter rate depends on the chemical and physical properties of the combustible mixture. The fractional increase zeta in the area of th post-shock stream tube, evaluated over a chemical kinetic distance equal to the cell length, has been identified as a parameter which satisfactorily characterizes the competition between these two rate processes. For zeta less than about 20%, the chemical processes survive the gasdynamic expansion and self-sustained propagation is possible. However, under these supercritical conditions, the wave propagates with a velocity deficit which appears to be a universal and theoretically predictable function of zeta. For zeta greater than 20%, the shock/reaction zone coupling breaks down, resulting in failure of the wave. The critical conditions for the propagation of detonation waves subjected to a wide range of expansion inducing mechanisms, including viscous boundary layers, compressible boundary gases and yielding walls, are all found to be consistent with the 20% criterion. However, the criterion becomes inapplicable as the cell size approaches the characteristic transverse dimension of the geometry. GRA

N86-21804# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering.
VISCOUS FLUID MOTION IN A SPINNING AND NUTATING CYLINDER Contractor Report, Aug. 1983 - Apr. 1985
Thorwald Herbert Nov. 1985 124 p Document previously announced as N86-14954
(Contract DAAK11-83-K-0011)
(AD-A162686; CRDC-CR-86004) Avail: NTIS HC A06/MF A01 CSCL 20/11

Spin-stabilized projectiles with liquid payloads can experience a severe flight instability characterized by a rapid yaw-angle growth and a simultaneous loss in spin rate. Laboratory experiments and field tests have shown that this instability originates from the internal fluid motion in the range of high viscosity. After evaluation of the experimental data and analysis of the equations for the fluid motion in a spinning and nutating cylinder, we have developed a simple model of this flow. Disregarding the finite length of the cylinder, this model provides the flow field and the viscous contribution to the liquid moments in analytical form. At low Reynolds number, the flow field agrees well with computational results for the center section of a cylinder of aspect ratio 4.3. The roll moment caused by this flow largely agrees with experimental data for a wide range of reynolds numbers. Estimates of the temperature variation indicate that discrepancies at very low Reynolds numbers may originate from associated changes of the viscosity during the experiments. The flow in an infinitely long cylinder has been utilized as a basic flow subject to axially periodic cellular disturbances. Both, the inviscid and the viscous situations have been studied. Parametric excitation of the cellular motions has been found at low Reynolds numbers. A small experiment has been designed to visualize this cellular motion in a finite-length cylinder.
Author (GRA)

N86-21805# Department of the Air Force, Washington, D.C.
COMPUTER CONTROLLER OPTICAL SURFACING (CCOS) LAP PRESSURE CONTROL SYSTEM Patent Application
Greenleaf, inventor (to Air Force) Filed 18 Sep. 1985 15 p
(AD-D011985; US-Patent-Appl-SN-777141) Avail: NTIS HC A02/MF A01 CSCL 20/4

A rotary lapping system and process is disclosed for producing a controlled pressure gradient, including positive and negative lift, when lapping a workpiece coated with an abrasive slurry liquid with a plurality of grinding pads mounted beneath a rotating lap substrate. To obtain positive and negative lift, the grinding pads are tilted with respectively a positive and negative angle of attack, which hydrodynamically reacts with the abrasive slurry liquid to produce the desired lift. The controlled pressure gradient is further varied by decentering the rotation of lap substrate. GRA

N86-21806# Los Alamos National Lab., N. Mex.
TRANSIENT HEAT PIPE INVESTIGATIONS FOR SPACE POWER SYSTEMS
M. A. Merrigan, E. S. Keddy, and J. T. Sena 1985 19 p ref Presented at the 2nd SP-100 Program Integration Meeting, Denver, Colo., 17 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000813; LA-UR-85-3341; CONF-8509153-4) Avail: NTIS HC A02/MF A01

A 4-meter long, high temperature, high power, molybdenum-lithium heat pipe has been fabricated and tested in transient and steady state operation at temperatures to 1500 K. Maximum power throughput during the tests was approximately 37 kW/cm(2) for the 1.4 cm diameter vapor space of the annular wick heat pipe. The evaporator flux density for the tests was 150.0 W/cm(2) over a length of 40 cm. Condenser length was approximately 3.0 m with radiant heat rejection from the condenser to a coaxial, water cooled radiation calorimeter. A variable radiation shield, controllable from the outside of the vacuum enclosure, was used to vary the load on the heat pipe during the tests. DOE

N86-21807# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
FLUID SLOSH STUDIES FOR SPINNING SPACECRAFT Final Report
J. P. Guibert, F. Jouhaud, and J. C. Garnier Paris ESA 26 Mar. 1985 114 p refs Original contains color illustrations
(Contract ESTEC-5327/83-NL-BI(SC))
(ONERA-RT-8/3269-SY; ESA-CR(P)-2101) Avail: NTIS HC A06/MF A01

An approximate method for calculation of sloshing modes in a spinning container is outlined. An eigenvalue problem for the essential modes is obtained by assuming that liquid velocity can be represented as a combination of known admissible flows, either irrotational or rotational with uniform vorticity. A test facility for fluid slosh investigation is presented. Model tanks are subjected to a forced precession motion by two driven tables, and slosh moment exerted by liquid is measured by quartz load washers. This moment allows spacecraft divergence rate to be estimated. Test results for cylindrical tanks with hemispherical ends clearly show liquid resonances and prove very encouraging. Author (ESA)

N86-21808# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Reaktorsicherheit.
THE DYNAMICS OF HEAT TRANSFER IN A TURBULENT PIPE FLOW, PART 2
Heinz Schmidl Jul. 1985 55 p refs In GERMAN; ENGLISH summary
(OEFZS-4325-Pt-2; RS-254/85-Pt-2) Avail: NTIS HC A04/MF A01

The general differential equation resulting from the energy equation for temperature distribution in a turbulent pipe flow is solved. The solution is split into several systems, leading to a general solution of heat transfer. The power series coefficient (Cv)

functions are determined. The general differential equation is solved for n = 1 and 2. Calculations are made for Ln and Mn (power series coefficients) for n > 2. The multiplication of two and three polynomials is discussed as well as the complete determination of the first and second system of the solution. Author (ESA)

N86-21809# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
THE EVOLUTION OF A WAVE TRAIN IN A THREE-DIMENSIONAL BOUNDARY LAYER
Jan Nordstroem 1 Oct. 1985 45 p refs
(Contract STU-84-4563)
(FFA-TN-1985-54) Avail: NTIS HC A03/MF A01

A computer code (VAX-11 FORTRAN) to determine the stability characteristics of a three-dimensional incompressible boundary layer was developed. A single wave component is followed downstream and all its important stability characteristics, such as frequency, wave number, and group velocity are calculated. In the code the laminar boundary layer is calculated for an infinite swept wing, and the velocity profiles for that flow case are used as input to the stability calculation. In the stability calculation the conventional shooting method is used with a nearly globally convergent search procedure. The source code is listed.
Author (ESA)

N86-21810# Oxford Univ. (England). Dept. of Engineering Science.
THE DEVELOPMENT OF A HEAT TRANSFER MEASUREMENT TECHNIQUE FOR APPLICATION TO ROTATING TURBINE BLADES
J. E. Doorly Mar. 1985 181 p refs
(OUEL-1584/85) Avail: NTIS HC A09/MF A01

A technique which allows heat transfer rate measurements on fully rotating test facilities using multilayered model turbine blades comprising an electrical insulator on a metal base is described. An accurate and computationally efficient method for determining the surface heat flux to a multilayered model turbine blade is developed theoretically, together with a method for calibrating the thermal properties of the multilayered system. This method allows the heat flux measurement technique, which utilizes electronic analog circuitry with thin film surface thermometers on a model made from a thermal insulator, to be extended for application to multilayered models. The production of test models by applying a vitreous enamel (as an electrical insulator) to a mild steel, is identified as the most suitable coating technique for experimental application. Radiant and wind tunnel testing for multilayered cylindrical models confirm that the method is practical and accurate. Author (ESA)

N86-21811# Oxford Univ. (England). Dept. of Engineering Science.
EXPERIMENTAL STUDIES ON CAVITATION INCEPTION IN A SUBMERGED JET
R. E. Franklin and J. Rozewicz 1985 42 p refs
(Contract MOD-ER/1/9/4/2057/093-ARE-T)
(OUEL-1586/85) Avail: NTIS HC A03/MF A01

The characteristics, intensity, and spectral distribution of the noise generated at cavitation inception and their variations with the diameter of the jet orifice were studied. In the noncavitating range the rms pressure changes proportionally to root sigma. The inception range is characterized by a sharp increase of rms pressure with reduction in cavitation number. Comparison of statistically counted crossings of the pressure fluctuation signal through zero level, to those expected for a random signal with normal distribution, indicates that in the inception range the pressure fluctuation impulses do not obey the characteristics of random impulses with normal distribution. Investigation of the power spectral density (PSD) functions shows that when PSD curves are presented in log-log scale, they are enclosed by two envelopes. The lower one is a theoretical noncavitating, no-air spectra line. For the noncavitating range the spectrum is the same at lower frequencies as the theoretically predicted one, but increases slightly at higher frequencies. Author (ESA)

N86-21812# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Trans-Ueberschall-Entwurfsverfahren.
A DIRECT METHOD TO CALCULATE DISTURBANCE FIELDS OF MOVING BODIES AT SUBSONIC SPEEDS IN COMPRESSIBLE MEDIA Ph.D. Thesis - Technische Univ., Brunswick, West Germany
Hans-Heinrich Kohlmeier Apr. 1985 100 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-977)
(DFVLR-FB-85-52; ISSN-0171-1342) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 30

A panel method for the analysis of three-dimensional steady compressible subsonic flow was developed. It is based on a first order panel method, into which Mach-number dependent aerodynamic influence coefficients are incorporated. The procedure using linearized theory takes into account the real magnitudes of potentials and velocities that are induced by disturbance sources at a point in space and which in compressible flow differ from that in incompressible flow. In this way it is possible to apply the exact boundary condition directly at the original body surface. Comparisons of solutions obtained by this method with measurements and with the results from methods solving full potential equation show good agreement for subcritical Mach numbers.
Author (ESA)

N86-22259# Joint Publications Research Service, Arlington, Va.
NUMERICAL SOLUTION OF PROBLEM ON DECAY OF HIGH-TEMPERATURE REGION OF RADIATING GAS WITH VARIOUS INITIAL INTERNAL ENERGY DISTRIBUTIONS Abstract Only
V. P. Korobeynikov, B. V. Putyatin, and A. K. Sharipov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 6 Transl. into ENGLISH from Doklady Akademii Nauk Tadzhikskoy SSR (Dushanbe, USSR), v. 27, no. 11, Nov. 1984 p 633-636 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22260# Joint Publications Research Service, Arlington, Va.
SHOCKWAVE PROPAGATION IN LOW-TEMPERATURE CARBON PLASMA Abstract Only
A. M. Galkin, N. N. Sysoev, and F. V. Shugaev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 7 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta Seriya 3: Fizika Astronomiya (Moscow, USSR), v. 26, no. 2, Mar. - Apr. 1985 p 77-80 Original language document was announced in IAA as A85-37374 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-21813 National Physical Lab., Teddington (England). Div. of Materials Applications.
RELATIVE INTENSITY-ENERGY CALIBRATION OF X-RAY PHOTOELECTRON SPECTROMETERS: INSTRUCTIONS FOR THE USE OF REFERENCE MATERIALS SCAA83
M. P. Seah and M. T. Anthony Jan. 1985 20 p refs
(NPL-DMA(A)-97; ISSN-0143-7313) Copyright. Avail: Issuing Activity

Two methods involving the use of the reference samples SCAA83 to relate the intensity-energy response functions from one X-ray photoelectron spectrometer used for quantitative surface analysis to another with an accuracy better than 5% were

established. The instructions given were used for the original interlaboratory comparison to test the reference procedure and to determine the transmission functions of a limited set of instruments. Details for the handling of the reference samples, the operation of the spectrometer, and the reporting of results are enclosed. Author (ESA)

N86-21814 National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
THE MEASURING ASSEMBLY FOR A PRIMARY STANDARD ABSORBED DOSE CALORIMETER
Alan R. DuSautoy Oct. 1985 38 p refs
(NPL-RS(EXT)-74; ISSN-0143-7135) Copyright. Avail: Issuing Activity

A measuring assembly with which a calorimeter forms a stable and accurate means to measure local absorbed dose in high energy photon or electron beams is described. The assembly contains ac bridges with phase sensitive detectors which provide good noise rejection and high sensitivity for the measurement of very small temperature changes sensed by thermistors in the calorimeter. The system functions automatically under microcomputer control providing data collection and processing as well as the means for calibration by electrical heating. The circuits and operation of the calorimeter in various modes are described. Author (ESA)

N86-21815*# National Aeronautics and Space Administration, Washington, D.C.
INFRARED DIAGNOSIS USING LIQUID CRYSTAL DETECTORS
M. Hugenschmidt and K. Vollrath Feb. 1986 19 p refs Transl. into ENGLISH of "Infrarotdiagnostik mit Hilfe von Fluessigkristall-detektorn" rept. no. BMVG-FBWT-73-16 West German Ministry of Defense and the Institute Franco-Allemand de Recherches, St. Louis, France and Weil, West Germany, 1972 p 1-21 Original language document was announced as N73-32564 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77999; NAS 1.15:77999; BMVG-FBWT-73-16) Avail: NTIS HC A02/MF A01 CSCL 14B

The possible uses of pulsed carbon dioxide lasers for analysis of plasmas and flows need appropriate infrared image converters. Emphasis was placed on liquid crystal detectors and their operational modes. Performance characterstics and selection criteria, such as high sensitivity, short reaction time, and high spatial resolution are discussed. Author

N86-21816*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
RESPONSE TIME FOR MULTILAYERED PLATINUM RESISTANCE THERMOMETERS Final Report, 4 Dec. 1984 - 30 Mar. 1985
D. K. Pandey and R. L. Ash Jul. 1985 34 p refs
(Contract NAS1-17099)
(NASA-CR-176655; NAS 1.26:176655) Avail: NTIS HC A03/MF A01 CSCL 14B

Response time constants for several multilayered temperature transducers were determined numerically by using Martin Marietta's MITAS software package which is available at NASA Langley Research Center. Present results were found in close agreement with the solutions reported in the literature, thus, the capability of MITAS was justified. On the basis of experiences gained, the MITAS is recommended for use in predicting the response time constants of sensors by an in-situ technique. Author

N86-21817*# United Technologies Research Center, East Hartford, Conn.
DEMONSTRATION TEST OF BURNER LINER STRAIN MEASURING SYSTEM Final Report
Karl A. Stetson Jun. 1984 96 p refs
(Contract NAS3-23690)
(NASA-CR-174743; NAS 1.26:174743; R84-926376-15) Avail: NTIS HC A05/MF A01 CSCL 14B

A demonstration test was conducted for two systems of static strain measurement that had been shown to have potential for application jet engine combustors. A modified JT12D combustor was operated in a jet burner test stand while subjected simultaneously to both systems of instrumentation, i.e., Kanthal A-1 wire strain gages and laser speckle photography. A section of the burner was removed for installation and calibration of the wire gages, and welded back into the burner. The burner test rig was modified to provide a viewing port for the laser speckle photography such that the instrumented section could be observed during operation. Six out of ten wire gages survived testing and showed excellent repeatability. The extensive precalibration procedures were shown to be effective in compensating for the large apparent strains associated with these gages. Although all portions of the speckle photography system operated satisfactorily, a problem was encountered in the form of optical inhomogeneities in the hot, high-pressure gas flowing by the combustor case which generate large and random apparent strain distributions. Author

N86-21818# SRI International Corp., Menlo Park, Calif. Computer Science and Technology Div.
INSTALLING A COPY OF THE ARPA/DMA IMAGE UNDERSTANDING TESTBED AT THE US ARMY ENGINEER TOPOGRAPHIC LABORATORIES Final Technical Report, 30 Jul. 1982 - 30 Jun. 1985
Andrew J. Hanson 10 Jun. 1985 10 p Prepared for DARPA, Arlington, Va.
(Contract MDA903-82-C-0385; ARPA Order 7; ARPA Order 3862)
(AD-A158394) Avail: NTIS HC A02/MF A01 CSCL 14/5

The Image Understanding Testbed system of hardware and software was established at the U.S. Army Engineer Topographic Laboratories (ETL) Research Institute. Tasks included preparation of the site for testbed system installation, purchase of required hardware, and arranging for availability of software systems. The ETL site was established as a node on the DDN ARPANET/MILNET network. Final tasks included installation of LISP machine software and associated consultation, as well as other general assistance and trouble shooting. Main beneficial results were the establishment of ETL of a state of the art research facility and the transfer of a large body of research technology. B.G.

N86-21819# California Univ., Santa Barbara. Dept. of Physics.
A TUNNELING MICROSCOPE FOR OPERATION IN AIR OR FLUIDS
B. Drake, R. Sonnenfeld, J. Schneir, P. K. Hansma, and G. Slough Oct. 1985 21 p Prepared in cooperation with Virginia Univ., Charlottesville
(Contract N00014-78-C-0011)
(AD-A161325; TR-19) Avail: NTIS HC A02/MF A01 CSCL 14/2

A tunneling microscope that is a hybrid between IBM Zurich designs and squeezable tunnel junctions has been oriented in air, oil, and liquid nitrogen. Key design goals were: (1) maximum rigidity, and (2) minimum thermal drift. Images of individual atoms in a close packed layer have been obtained under liquid nitrogen. GRA

N86-21820# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A SYNTHESIS OF RESEARCH ON COLOR, TYPOGRAPHY AND GRAPHICS AS THEY RELATE TO READABILITY M.S. Thesis
Melvin E. Lamoreaux Sep. 1985 161 p
(AD-A161340; AFIT/GLM/LSH/85S-40) Avail: NTIS HC A08/MF A01 CSCL 05/10

A foundation for future research on the use of color, typography, and graphics to improve readability is provided. Articles from the broad fields of education and psychology, as well as from the fields of journalism and printing, have been reviewed for research relating color, typography, and graphics to reading ease, speed, or comprehension. The most relevant articles reviewed are presented in an annoated bibliography; the remaining articles are also presented in bibliographic format. This literature review indicates that recognition and recall of printed material may be improved through the use of headings, underlining, color, and, especially, illustrations. Current research suggests that individuals can remember pictures far longer than past research indicates.

However, researchers are divided on the usefulness of illustrations to improve reading comprehension. On the other hand, reading comprehension can be improved through the use of statistical graphs and tables if the reader is properly trained in the use of these devices. GRA

N86-21821# Naval Postgraduate School, Monterey, Calif.
LOW-NOISE PHASE/FREQUENCY DETECTOR M.S. Thesis
John W. McCorkle Sep. 1985 62 p
(AD-A161394) Avail: NTIS HC A04/MF A01 CSCL 09/5

The purpose of the research reported on in this thesis, is to demonstrate the effectiveness of a new circuit technique proposed by the author to eliminate the dead-zone anomaly in a digital phase/frequency detector. In addition to demonstrating the elimination of the dead zone, a new loop filter is described. The filter takes advantage of the new phase detector circuit technique so as to simultaneously provide both low-level reference sidebands and a lock-up time of one cycle of the reference. Phase detectors are used in control systems to measure the phase of one signal relative to the phase of another signal. Control systems of this type are usually referred to as Phase-Locked-Loops (PLL). Development of phase detectors has occurred because of the PLL application. A new phase detector is described in this paper. GRA

N86-21822# Electronics Research Lab., Adelaide (Australia).
DETERMINATION OF THE MODULATION TRANSFER FUNCTION OF LINE SCANNED INFRARED IMAGING SYSTEMS
G. V. Poropat May 1985 37 p
(AD-A161521; ERL-0338-TR) Avail: NTIS HC A03/MF A01 CSCL 14/5

A computer model to determine the Modulation Transfer Function of a line scanned imaging system is discussed. The model can incorporate the effects of the atmospheric path, the system optics and the display as well as the detector's resolution limits. It can be used with single element or SPRITE detectors and its application to a design task is discussed. GRA

N86-21823# Aeronautical Research Labs., Melbourne (Australia).
A CONDITIONAL SAMPLING MODULE FOR THE TSI LASER DOPPLER ANEMOMETER COUNTER PROCESSOR
Warren H. Harch Jul. 1985 20 p
(AD-A161555; ARL/AERO-PROP-TM-428) Avail: NTIS HC A02/MF A01 CSCL 14/2

A module is described that is fully compatible with TSI Laser Doppler Counter Processors and Interfaces and which, when installed, permits conditional sampling of the TSI Laser Doppler Anemometer Output at some predetermined cyclic or externally imposed rate. GRA

N86-21824# Lockheed Missiles and Space Co., Palo Alto, Calif.
SPECTRAL IMAGING WITH A CID CAMERA Final Report, 4 Feb. 1982 - 14 Sep. 1984
Theodore D. Tarbell 22 Mar. 1985 84 p
(Contract F19628-82-C-0030)
(AD-A161608; LMSC/F059543; AFGL-TR-85-0075) Avail: NTIS HC A05/MF A01 CSCL 03/2

The electron velocity distribution is calculated for an idealized model of the high electron mobility transistor using a many-particle Monte Carlo model and a self-consistent two-dimensional Poisson solver. Hot electron effects, nonstationary effects, and real space transfers are analyzed. The results show that significant velocity overshoot 2.8 X 10 to the power 7th cm/s at 300 K and 3.7 X 10 to the 7th power cm/s at 77 K exits under the gate and that the velocity overshoot; is limited by both k-space transfer and real-space transfer. The value of the overshoot is limited by both k-space transfer and real-space transfer. The values of the overshoot velocities are much smaller that those obtained from the more conventional drift-diffusion model. GRA

N86-21825# Panametrics, Inc., Waltham, Mass.
FABRICATE, CALIBRATE AND TEST A DOSIMETER FOR INTEGRATION INTO THE CRRES (COMBINED RELEASE AND RADIATION EFFECTS SATELLITE) Scientific Report, 1 Sep. 1983 - 31 Aug. 1984
Paul R. Morel Mar. 1985 32 p
(Contract F19628-82-C-0090)
(AD-A161695; AFGL-TR-85-0150; SR-2) Avail: NTIS HC A03/MF A01 CSCL 22/2

A space-radiation dosimeter is being fabricated, calibrated, tested, and integrated into the CRRES satellite. This Dosimeter is essentially identical to that previously designed, fabricated, calibrated, tested and integrated into the DMSP F7 satellite. These dosimeters are primarily designed to measure the dose from electrons of greater than 1 MeV to greater than 10 MeV in four channels. Each channel has a different thickness aluminum dome. The solid state detector outputs are processed to provide the dose from electrons (low energy loss), the dose from protons (high energy loss), the flux of electrons, the flux of protons, and the rate of high energy loss nuclear star events. The dosimeter also has a calibration mode in which the alpha particles from a weak source behind each detector are used to check for total detector depletion and proper operation of the electronics. GRA

N86-21826# University Coll. of North Wales, Bangor.
DEVELOPMENT OF SHEAROGRAPHIC IMAGING SYSTEM Periodic Report
D. K. Das-Gupta, K. Doughty, and S. M. Farrington 24 Sep. 1985 12 p
(Contract DAJA45-84-C-0042)
(AD-A161819; R/D-4679-EE-01; Periodic-2) Avail: NTIS HC A02/MF A01 CSCL 14/5

Since the submission of the First Periodic Report no significant progress in these laboratories was made until the delivery of a 50 mW. helium-neon laser from Spectra Physics together with a spatial filtering unit. The present report gives details of the adopted experimental arrangements and also includes photographs of the shearographic fringes obtained for a number of displacements of a stainless steel sample. The basic arrangement for image shearing is shown in schematic form. In our arrangement the 1 degree optical wedge covering half the field was mounted in the filter-holder of a Toyo-View Model 45E Plate camera fitted with a 150 mm. f5.6 compound lens. The test samples employed in the present work were stainless steel discs of 0.15mm. thickness and 80 mm. diameter. One surface of the disc was sprayed matt white using a cellulose-based can of automobile touch-up paint in order to increase the reflectivity of the sample surface. Also drawn on this white surface were two fine intersecting lines, one in the horizontal plane and the other in the vertical plane. The sample was mounted on a block of aluminum which had a central cut-out through a point force could be applied. GRA

N86-21827# Los Alamos National Lab., N. Mex.
CONCEPTUAL DESIGN AND ANALYSIS OF HIGH SPEED ELECTRONIC IMAGING Final Technical Report, Nov. 1982 - Sep. 1984 on Phase 1
Randy Brown and J. R. Parker Oct. 1985 54 p
(Contract MIPR-FY7621-83-90003; AF Proj. 2567)
(AD-A161825; AD-E801223; LA-10072-MS; AFATL-TR-85-65)
Avail: NTIS HC A04/MF A01 CSCL 14/2

This study addresses the feasibility of using electronic imaging technology for aeroballistics research. Electronic imaging devices are analyzed with respect to range system characteristics. Optical imaging and illumination parameters in the existing system are defined and quantified. System imaging capability is measured and described by modern imaging systems analysis in terms of the system response to a step function input. Two independent measurements that determine system illumination are described and supporting analysis is included. Concepts critical to data analysis are discussed, along with a survey of available hardware that will image and process projectile flight path data. Recommendations pertinent to the selection of hardware and the overall system organization and maintenance are made. GRA

N86-21828# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN OPTICOACOUSTIC CORRELATION SPECTRAL ANALYZER
S. V. Kulakov, B. P. Razzhivin, S. I. Sokolov, and D. V. Tigin 15 Nov. 1985 6 p Transl. into ENGLISH of Russian Patent no. 337750 (5 May 1972) p 1-2
(AD-A162406; FTD-ID(RS)T-1568-84) Avail: NTIS HC A02/MF A01 CSCL 20/14

The Patent concerns the field of radioengineering and is designed for the analysis of radio signal spectra. An opticoacoustic correlation spectral analyzer is known, containing a mixer, a band filter, a radio pulse generator and an indicator. The aim of the invention is to increase the product of the analysis band to speed up the analysis process. This is achieved by the fact that an opticoacoustic correlator with two ultrasonic light modulators is introduced into the analyzer, in which ultrasonic waves propagate in opposite directions. One of the modulators is connected to the output of the band filter, the other to the output of the radio pulse generator. GRA

N86-21829# Arizona Univ., Tucson. Dept. of Chemistry.
CHARACTERIZATION OF A CHARGE INJECTION DEVICE CAMERA SYSTEM FOR SPECTROCHEMICAL MEASUREMENTS Interim Report
G. R. Sims and M. B. Denton 25 Nov. 1985 46 p
(Contract N00014-83-K-0268)
(AD-A162472; TR-40) Avail: NTIS HC A03/MF A01 CSCL 14/5

An electronic camera system employing a CID-11B Charge Injection Device (CID) detector is described. Unique capabilities of this camera system, including destructive and nondestructive readout modes, signal-to-noise enhancement through multiple nondestructive readouts, and pseudo random pixel addressing are discussed. The performance characteristics related to spectrometric applications are presented. Parameters discussed include sensitivity, linearity, noise, dynamic range, blooming, pixel crosstalk, and spectral response. The CID appears to be uniquely qualified among imaging detectors to fulfill those requirements for an imaging spectroscopic detector presented at the beginning of this manuscript. The sensitivity of the CID-11B has been shown to be very good over a wide spectral range. The effective readout noise can be made to be very low, and the device is not susceptible to readout lag or blooming. In addition, this device has a highly linear response function and, when operated at cryogenic temperatures, exhibits virtually no thermal charge generation. While the CID-11B does suffer from a form of spatial pixel crosstalk, .this effect is both understood and easily compensated for. GRA

N86-21830# Department of the Air Force, Washington, D.C.
UNIVERSAL WAVEFRONT SENSOR APPARATUS Patent Application
John T. Watson, inventor (to Air Force) Filed 8 Aug. 1985 19 p
(AD-D011983; US-Patent-Appl-SN-763576) Avail: NTIS HC A02/MF A01 CSCL 20/6

A wavefront sensor apparatus for a large optical system, such as a telescope, having a reticle with at least one slit therein to provide image signatures for various portions of the aperture to an array of infrared sensor cells. The time differences between the image signatures represents relative image displacement caused by the wavefront slope variation in the actual wavefront. GRA

N86-21831# Department of the Air Force, Washington, D.C.
APPARATUS FOR TRANSMITTING DATA FROM HIGH SPEED ROTORS Patent Application
Wayne K. Movick, inventor (to Air Force) Filed 4 Jan. 1985 8 p
(AD-D011991; US-Patent-Appl-SN-688943) Avail: NTIS HC A02/MF A01 CSCL 09/6

This patent application discloses an apparatus for transmitting electric and pneumatic signals from a high speed rotating test item. All of the sensor wires having electric signals from strain and/or temperature sensors are converted to stationary wires by a slip ring assembly. A pneumatic tube is selected for output by a multichannel pressure select valve. This selected pneumatic tube is passed through the slip ring assembly to a stationary transducer that converts the pneumatic signal to an electric signal on a stationary wire. GRA

N86-21832# NLO, Inc., Cincinnati, Ohio.
DETERMINATION OF TRI-n-BUTYL PHOSPHATE (TBP) IN THE TBP-MVARSOL-HNO3 SYSTEM USING PRECISION DENSIMETRY
H. T. Matsuda, B. F. deAraujo, and J. A. deAraujo 1985 12 p Translation of IPEN Publication No. 23, May 1981 Presented at the 21st Brazilian Congress of Chemistry, Porto Alegre, Brazil, 21 Oct. 1980 Prepared in cooperation with Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, Brazil
(Contract DE-AC05-76OR-01156)
(DE86-001607; NLCO-tr-20; CONF-8010269-8) Avail: NTIS HC A02/MF A01

A simple and rapid method for the direct determination of TBP using precision densimetry is presented, which is designed to determine the solvent concentration in the TBP-Varsol system during the irradiated-uranium treatment process, now being introduced at the Chemical Engineering Center of the Institute for Energy and Nuclear Research. DOE

N86-21833# Sandia National Labs., Albuquerque, N. Mex.
AUTOMATED INSTRUMENT FOR QUALITATIVE ANALYSIS OF PHOTOGRAPHICALLY RECORDED SPECTRA
W. A. Hareland and D. M. Melsaard 1985 12 p Presented at the 28th Conference on Analytical Chemistry, Knoxville, Tenn., 30 Sep. 1985 Prepared in cooperation with J and M Systems, Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-001621; SAND-85-1361C; CONF-850937-1) Avail: NTIS HC A02/MF A01

An advanced technique has been developed for the identification of element spectral lines in photographically recorded emission spectra. It is based on measurement of the relative position of a line on the photoplate and calculation of the wavelength using an equation derived from measured positions of known spectral lines. With this technique, the wavelength of any line can be determined to within 0.04 Angstrom over a 1000 Angstrom region. The elements are identified by comparing the calculated wavelengths with known values in the MIT Wavelength Tables and verified based on the wavelengths of the most intense spectral lines. The automated instrument can be applied to the analysis of photographically recorded spark source mass spectra. Isotopes can be identified based on their mass-to-charge ratios which are calculated from the measured positions of the lines on the photoplate. DOE

N86-21834# Los Alamos National Lab., N. Mex.
CALIBRATION OF A MONOCHROMATOR/SPECTROMETER SYSTEM FOR THE MEASUREMENT OF PHOTOELECTRON ANGULAR DISTRIBUTIONS AND BRANCHING RATIOS
S. H. Southworth, A. C. Parr, J. E. Hardis, J. L. Dehmer, and D. M. P. Holland 1985 19 p refs Presented at the 2nd International Synchrotron Radiation Instrumentation Conference, Stanford, Calif., 29 Jul. 1985 Prepared in cooperation with National Bureau of Standards, Washington, D.C., Argonne National Lab., Ill., and Daresbury Nuclear Physics Lab., England
(Contract W-7405-eng-36)
(DE86-000789; LA-UR-85-3113; CONF-850734-13) Avail: NTIS HC A02/MF A01

We describe the techniques used in calibrating a monochromator/spectrometer system for gas-phase photoelectron angular distribution and branching ratio measurements. We report a self-consistent set of values for the Ne 2p, Ar 3p, Kr 4p sub 3/2 and 4p sub 1/2, and Xe 5p sub 3/2 and 5p sub 1/2 photoelectron asymmetry parameters and for the Kr 4p sub 3/2:4p sub 1/2 and Xe 5p sub 3/2:5p sub 1/2 branching ratios for the energy regions from threshold to approximately 15 iV. DOE

N86-21835# Brookhaven National Lab., Upton, N. Y.
SAFEGUARDS INSTRUMENTATION: A COMPUTER-BASED CATALOG, SECOND EDITION
C. Auerbach Apr. 1985 189 p

(Contract DE-AC02-76CH-00016)
(DE86-000840; BNL-51450-2nd-Ed) Avail: NTIS HC A09/MF A01

This catalog contains entries on new developments and on items listed in BNL 51450, which have either been carried over unchanged or been updated. More than 70 entries were deleted because of either obsolescence, insufficient interest in terms of safeguards, or lack of documentable development activities in recent years. Some old listings as well as new material was consolidated into more generic entries. As in the earlier document, the emphasis is on devices and instruments that are either in field use at this time or under active development. A few items such as NDA reference materials, instrument vans and certain shipping containers are included because they are important adjuncts to optimum utilization of safeguards instrumentation. This catalog does not include devices for physical protection. As was the case with its predecessor, most of the material in this catalog originated in the US and Canada; a few contributions came from member states of the European Community. DOE

N86-21836# Oak Ridge Gaseous Diffusion Plant, Tenn.
IMPROVED AMPHOTERIC ION EXCHANGER AND ITS MANUFACTURING METHOD
Tadao Kodaka and Hiroshi Onuma 1985 18 p Translation of Japanese Patent 59-105,848 (June 19, 1984)
(Contract DE-AC05-84OT-21400)
(DE86-001608; K-Trans-301) Avail: NTIS HC A02/MF A01

This invention relates to an amphoteric ion exchanger comprising a block copolymer composed of a polymer chain poly A(-) having a cation exchange group, poly B(+) polymer chain having an anion exchange group, and poly C polymer chain not having an ion exchange group, among which the constituent poly chain C is produced by adding hydrogen to a diene-group polymer. A multiphased structure material having both regions of cation and anion exchange groups is expected to provide an unusual characteristic because of its effect of fixed level of amphoteric electric charge. An amphoteric ion exchange is to be manufactured with the use of a three-dimensional block copolymer having a diene-group polymer chain as a constituent block capable of being easily bridgeable without introducing an ion exchange group in addition to the use of polymer chains to which a cation or anion exchange can be introduced. This method requires, at the same time, very careful selections of reaction conditions for sulfonizing the added diene-group polymer, which does not have sufficient chemical strength. The present inventors have found that an amphoteric ion exchange with excellent chemical strength can be manufactured by hydrogenating the polydiene group region of a block copolymer, consisting of three constituents having such a diene-group polymer chain. DOE

N86-21837# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
IMPROVEMENTS AND APPLICATION OF A NEW TYPE OF THREE COMPONENT LASER DOPPLER VELOCIMETER
M. Carbonaro, Enrico DAmato (Aquila Univ., Italy), and Enrico P. Tomasini (Aquila Univ., Italy) Oct. 1984 32 p refs
(VKI-TM-37) Avail: NTIS HC A03/MF A01

A velocimeter to measure the velocity components in a three dimensional flow field was designed and built. The system uses a set of six monochromatic laser beams converging in the same probe volume, and a single photomultiplier receiving optic. A procedure based on a combination of light frequency shifting, filtering, light chopping, and time sampling, was used to separate the Doppler signals corresponding to the various components of velocity. The 45 deg offset forward scattering scheme performs satisfactorily in flow fields with small acceleration such as a jet flow, where in large particles can be used. In larger acceleration flows such as vortex wakes of aircraft and missiles, smaller particles have to be used, and this imposes the adoption of a combined forward scattering scheme. Author (ESA)

N86-21838# Stockholm Univ. (Sweden). Dept. of Meteorology.
A PULSE AMPLIFIER/DISCRIMINATOR (PAD) FOR SINGLE PHOTON COUNTING
Alexander Lennart Sep. 1985 16 p refs Sponsored by Swedish Board for Space Activities
(AP-24; ISSN-0280-4441) Avail: NTIS HC A02/MF A01

The LeCroy MVL 100 pulse amplifier/discriminator (PAD) was evaluated for use in single photon counting. Count rate as a function of photon flux when used with an EMI 9924B photomultiplier; pulse pair resolution time; power requirements; and necessary additional components were assessed. The pulse amplifier is found to be reliable, fast, and small. The circuit diagram and the printed circuit board layout are included. Author (ESA)

N86-21839# National Bureau of Standards, Gaithersburg, Md. Center for Manufacturing Engineering.
SIZING OF POLYSTYRENE SPHERES PRODUCED IN MICROGRAVITY
G. Mulholland, G. Hembree, and A. Hartman Jul. 1985 26 p refs
(PB86-102241; NBSIR-84/2914) Avail: NTIS HC A03/MF A01 CSCL 14B

The standard deviation of the size distribution was determined for a polystyrene latex produced in a space shuttle experiment and in an Earth-bound control experiment. Values determined from direct measurement of transmission electron micrographs, corrected for magnification distortion, were 0.035 micrometer for the space grown material and 0.15 micrometer for the control. The standard deviations obtained from an aerodynamic particle sizer were only slightly greater than those obtained by TEM; 0.042 micrometer and 0.20 micrometer for the shuttle and ground material respectively. However these values were produced in a few hours versus the several weeks it took for the electron microscopy. Both of the techniques used here resulted in measured standard deviations significantly smaller than those previously reported for this material. GRA

N86-21724# Joint Publications Research Service, Arlington, Va.
EARTH SENSOR FOR ARTIFICIAL SATELLITE CONTROL DISCUSSED
Kunio Nakamura and Matsushita Giken *In its* Japan Report: Science and Technology (JPRS-JST-86-001) 10 Jan. 1986 p 1-12 refs Transl. into ENGLISH from Sensa Gijutsu (Tokyo, Japan), May 1985 p 69-74 (For primary document see N86-21723 12-31)
Avail: NTIS HC A04/MF A01

N86-21936*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NASA EXPERIMENTS ON THE B-720 STRUCTURE AND SEATS
Emilio Alfaro-Bou *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 29-47 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

N86-21948*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IMPACT DYNAMICS INSTRUMENTATION
Royce F. McCormck *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 289-301 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

N86-22496# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France).
BOLOMETERS AS SPECTROMETERS FOR X-RAY ASTRONOMY
N. Coron, G. Artzner, G. Dambier, G. Jegoudez, J. Leblanc, J. Y. Deschamps (CEA, Saclay, France), R. Rocchia (CEA, Saclay, France), A. Tarrius (CEA, Saclay, France), O. Testard (CEA, Saclay, France), H. R. Ravn (CERN, Geneva, Switzerland) et al *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 229-231 refs (For primary document see

N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22497# Consiglio Nazionale delle Ricerche, Bologna (Italy). Ist. di Technologie e Studio delle Radiazioni Extraterrestri.
ROOM TEMPERATURE SOLID STATE SPECTROMETER FOR X-RAY ASTRONOMY
G. DiCocco, W. Dusi, C. Labanti, G. F. Spada, G. Ventura, and P. Siffert *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 233-236 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22499# Danish Space Research Inst., Lyngby.
A MULTIWIRE PROPORTIONAL COUNTER FOR LOW ENERGY X-RAY IMAGING
M. M. Madsen, P. Jonasson, P. L. Jensen, H. E. Rasmussen, P. Orup, and H. W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 245-254 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22502# Danish Space Research Inst., Lyngby.
OBJECTIVE CRYSTAL SPECTROMETER (OXS) FOR IMAGING EXTENDED COSMIC X-RAY SOURCES
H. W. Schnopper and B. Byrnak *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 283-286 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22503# Mullard Space Science Lab., Dorking (England).
THE PENNING GAS IMAGER IN A SPACE APPLICATION
Hugo E. Schwarz *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 287-290 refs Sponsored by UK Science and Engineering Research Council (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-21840 Stanford Univ., Calif.
RESEARCH AND DEVELOPMENT OF A HIGH AVERAGE POWER PHOTOPROCESSING LASER SYSTEM Ph.D. Thesis
Kelin Jo Kuhn 1985 236 p
Avail: Univ. Microfilms Order No. Da8522180

In recent years, significant research effort has gone into applying laser physics to electronic device fabrication. Such applications range from generating laser plasmas for lithography X-ray sources to using laser light for rapid doping of device substrates. Unfortunately, no existing laser provides sufficient total peak power to photoprocess a large area at a reasonable (2 to 10 hertz) repetition rate. Development of a 40 joule, 5 hertz, zig-zag slab laser system capable of large area photoprocessing is reported. A new cooling technique which isolates the laser slab in a static gas chamber was used in the laser design. This technique permits precise control of thermal boundary conditions in large slab lasers. Application of this cooling technique to the large laser slabs necessary for photoprocessing resulted in the formulation of new scaling laws for large slab lasers. Large area photoprocessing operation of the laser was demonstrated by rapid (800 angstroms/second) deposition of silicon dioxide on a silicon substrate using a mixture of infrared (1.05 microns) and green (527.5 nanometers) laser light. Dissert. Abstr.

N86-21841*# National Aeronautics and Space Administration, Washington, D.C.
STIMULATED RAMAN SCATTERING OF LIGHT ABSORBING MEDIA EXCITED BY ULTRASHORT LASER PULSES
F. N. Marchevskiy, V. L. Strizhevskiy, and V. P. Feshchenko Oct. 1985 12 p refs Transl. into ENGLISH from Ukrainskiy Fizicheskiy Zhurnal (USSR), v. 24, no. 11, 1979 p 1746-1751 Original language document was announced in IAA as A80-25008 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-77903; NAS 1.15:77903) Avail: NTIS HC A02/MF A01 CSCL 20E

The fluctuation-dissipation theory of spontaneous and stimulated vibration Raman scattering is worked out taking into account the dissipation losses at frequencies of laser pump and scattering radiation. General expressions are found, which describe the absolute intensities and shape, energy and duration of scattered pulses in terms of the parameters of the medium and the the input laser pulses. The general regularities are analyzed in detail. Conditions are found for the realization of spontaneous or stimulated Raman scattering and its dependence on absorption, pulse duration and other parameters of the problem. Author

N86-21842# Naval Postgraduate School, Monterey, Calif.
LASER PROPAGATION CODE STUDY
Edward B. Rockower Sep. 1985 26 p
(Contract MIPR-TRASANA-5029)
(AD-A161370; NPS55-85-019) Avail: NTIS HC A03/MF A01 CSCL 20/5

A number of laser propagation codes have been assessed as to their suitability for modeling Army High Energy Laser (HEL) weapons used in an anti-sensor mode. A number of areas in which systems analysis HEL codes are deficient are identified. Most notably, available HEL scaling law codes model the laser aperture as circular, possibly with a fixed (e.g., 10%) obscuration. However, most HELs have rectangular apertures with up to 30% obscuration. A beam-quality/aperture shape scaling relation which can be useful when applying these codes to realistic designs for HELs is presented. GRA

N86-21843# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
BEHAVIOR OF SINGLET OXYGEN IN THE OXYGEN-IODINE TRANSFER LASER
Raymond F. Heidner, III 28 Sep. 1985 38 p
(Contract F04701-83-c-0084)
(AD-A161390; TR-0084(4610)-3; SD-TR-85-65) Avail: NTIS HC A03/MF A01 CSCL 07/5

The kinetic processes that affect the decay of O2Delta 1 in the oxygen-iodine transfer laser (COIL) are discussed. The kinetics of O2 removal in the absence of iodine are now quite well established. A brief review of this topic is presented. When I2 is added to O2, a distinction can be made between the behavior of O2 when I2 and iodine atoms are present and when I2 is fully dissociated into atoms. In the latter case, energy pooling between O2Delta 1 and I is the dominant process unless a strong I quencher (e.g., H2O) is present. In the former case, the O2Delta 1-driven chain reaction mechanism for I2 dissociation is the dominant feature of the kinetics. A detailed description of each of these regimes is critical in understanding the oxygen-iodine laser. GRA

N86-21844# Naval Research Lab., Washington, D. C.
PROCEEDINGS OF THE 38TH ANNUAL GASEOUS ELECTRONICS CONFERENCE: PROGRAM AND ABSTRACTS
18 Oct. 1985 125 p Proc. held at Monterey, Calif., 15-18 Oct. 1985
(AD-A161658) Avail: NTIS HC A06/MF A01 CSCL 09/3

A report on the 38th Annual Gaseous Electronics Conference, held at Monterey, California, 15-18 October 1985, includes articles on the following topics: electron-molecule collisions; excitation, XUV lasers, collision, discharges, photonics, electron-molecule collisions; attachment, high pressure arc lamps, ion-molecule reactions, DC-glows, electron-molecule collisions; total scattering and excitation, plasma chemistry, symposium on ion-molecule reactions, breakdown, Loeb commemorative session, heavy particle collisions, ionization and electron heating; gas lasers, sheaths and distribution functions, R-F discharges, arcs and switching, and invited lectures. GRA

N86-21845# Naval Research Lab., Washington, D. C.
HIGH VOLTAGE K SUB a -BAND GYROTRON EXPERIMENT Memorandum Report, Jan. 1984 - Mar. 1985
S. H. Gold, A. W. Fliflet, W. M. Manheimer, W. M. Black, and V. L. Granatstein 20 Nov. 1985 47 p
(RR0-1109; DNA Proj. X99-QMXV)
(AD-A161686; NRL-MR-5682) Avail: NTIS HC A03/MF A01 CSCL 20/7

A new high voltage, intense beam Ka band gyrotron experiment is underway, using a 350-400 keV, 0.5-1 kA beam from a short-pulse Febetron pulser. High power operation at 35 GHz has been observed, with 20 MW (+ or - 3 dB) produced at about 8.5% efficiency in a whispering-gallery TE62 mode. Operation in other modes, and at other frequencies has also been studied.
GRA

N86-21846# Harry Diamond Labs., Adelphi, Md.
HOST MATERIALS FOR TRANSITION-METAL IONS WITH THE ndN ELECTRONIC CONFIGURATION Data Summary
Clyde A. Morrison, Richard P. Leavitt, and Amanda F. Hansen Oct. 1985 19 p
(AD-A161782; HDL-DS-85-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

Data are given on 12 host materials for lasers that use the transition metal ions. Included in each section are the crystallographic data, X-ray data, lattice sum parameters A sub nm, crystal field parameters B sub nm(Dq), and spin-orbit constants (xi). One section contains the phenomenological free ion parameters F (superscript k), (xi) and alpha, which have been obtained by fitting the reported free ion data. There is a bibliography for each host which, dependent on that particular host, is more or less complete. The data contained on each host material as well as on new host materials will be added periodically. GRA

N86-21847# Department of the Air Force, Washington, D.C.
NOVEL METHODS FOR TUNING FREE ELECTRON LASERS TO MULTIPLE WAVELENGTHS Patent Application
William B. Colson, inventor (to Air Force) Filed 14 Aug. 1985 15 p
(AD-D011986; US-Patent-Appl-SN-765483) Avail: NTIS HC A02/MF A01 CSCL 20/5

The tuning of the output of a free electron laser to different wavelengths is accomplished using a tilting resonator. In a free electron laser, relativistic electrons travel through a periodic magnetic field and oscillate to amplify coherent optical radiation within a resonator with the same polarization as the magnet. Usually, the electron beam is parallel with the resonator axis and the fundamental harmonic is ordinarily used in the transverse magnetic field. By tilting the resonator axis with respect to the electron beam and transverse magnetic field, the free electron laser's output is tuned to different wavelengths. By using higher harmonics (f = 3,5,7,...) the free electron laser produces lasing in several wavelengths simultaneously. These several wavelengths are also tuned by the tilting resonator. GRA

N86-21848# Department of the Air Force, Washington, D.C.
REPETITIVELY PULSED Q-SWITCHED CHEMICAL OXYGEN-IODINE LASER Patent Application
Hager, inventor (to Air Force) Filed 7 Oct. 1985 19 p
(AD-D011989; US-Patent-Appl-SN-785186) Avail: NTIS HC A02/MF A01 CSCL 20/5

The present invention overcomes the problems of severe flux induced density gradients in a continuous wave subsonic cavity of a chemical oxygen-iodine laser by operating the laser in a repetitively pulsed mode through the incorporation therein of a scaleable intracavity gas phase Q-switch. This abstract discloses a repetitively cavity containing a lasing medium in the form of a flowing mixture of excited oxygen and iodine atoms and an iodine absorption region within the resonant cavity. The iodine absorption region includes a source of iodine atoms and a magnetic field associated therewith. Selectively altering the magnetic field results in changing the absorption characteristics of the iodine atoms and therefore effectively pulses the output of the laser. GRA

N86-21849# Oregon Graduate Center for Study and Research, Beaverton.
SEMICONDUCTOR LASER SOURCE FOR NATURAL GAS LEAK DETECTION Final Report, 1 Sep. 1984 - 31 Mar. 1985
R. A. Elliott Jun. 1985 39 p refs
(Contract GRI-5084-260-0998)
(PB86-102811; GRI-85/0140) Avail: NTIS HC A03/MF A01 CSCL 14B

The feasibility of using semiconductor lasers as infrared sources for handheld natural gas leak detectors was assessed. The detection system was assumed to be based on the differential absorption (DIAL) technique and to operate at ambient temperatures. The absorption spectra of the major components of natural gas, methane and ethane, were measured in the spectral range from 1.2 to 2.0 micrometers where cryogenic cooling of detectors is not required. Both spectra exhibited absorption features due to overtones of the fundamental C-H stretching modes strong enough to be suitable for DIAL measurements. It is found that lasers made from InGaAs emitting near 1.65 micrometers are suitable for methane detection however, considerable materials development would be needed to develop a laser for ethane detection.
GRA

N86-22261# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF EFFICIENCY OF UTILIZING ALPHA-RADIATION TO PRE-IONIZE THE WORKING MIXTURE IN GAS DISCHARGE LASERS AND AMPLIFIERS Abstract Only
N. G. Basov, V. A. Danilychev, V. N. Koterov, S. G. Perlov, T. M. Plyshevskaya, and A. M. Soroka *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 8 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 281, no. 5, Apr. 1985 p 1106-1110 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22262# Joint Publications Research Service, Arlington, Va.
FUTURE POSSIBILITIES OF FREE-ELECTRON LASER Abstract Only
A. N. Lebedev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 9 Transl. into ENGLISH from Priroda (Moscow, USSR), no. 9, Sep. 1984 p 28-36 Original language document was announced in IAA as A85-14873 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22263# Joint Publications Research Service, Arlington, Va.
NEW FINDINGS ON CREATION OF POWERFUL TUNABLE SUBPICOSECOND SOLID-STATE LASERS Abstract Only
V. Vasilyauskas, A. Piskarskas, V. Sirutkaitis, A. Stabinis, and A. Yankauskas *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 10 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Fizicheskaya (Moscow, USSR), v. 49, no. 3, Mar. 1985 p 493-499 Original language document was announced in IAA as A85-31861 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22264# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ELECTROMAGNETIC WAVE AND WIGGLER FIELDS INHOMOGENEITY ON A FREE-ELECTRON LASER Abstract Only
A. V. Serov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 11 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 516-521 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22265# Joint Publications Research Service, Arlington, Va.
EFFECT OF PULSE DEPENDENT DISCHARGE ON RELAXING GAS FLOW Abstract Only
V. A. Levin, V. V. Netesov, and Yu. V. Tunik *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 12

Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 540-545 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22266# Joint Publications Research Service, Arlington, Va.
IGLAN-3 MULTIBEAM CW GAS-DISCHARGE CO2 LASER Abstract Only
G. I. Kozlov and V. A. Kuznetsov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 13 Transl. into ENGLISH from Kvantovaya lektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 553-562 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04/MF A01

N86-22267# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF ELECTROIONIZATION PULSED CARBON DIOXIDE ISOTOPE OUTPUT CHARACTERISTICS Abstract Only
S. V. Bardakovskiy, N. M. Bladimirova, P. V. Sarubin, V. G. Lyakishev, A. A. Kholodilov, V. M. Tsarev, and N. V. Cheburkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 14 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 622-624 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22268# Joint Publications Research Service, Arlington, Va.
HYSTERESIS EFFECTS IN Ar+ LASER WITH NONLINEAR ABSORBER IN THE CAVITY Abstract Only
Kh. G. Gafurov and D. P. Krindach *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 15 Transl. into ENGLISH from Kvantovaya Elektronika Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 625-627 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22269# Joint Publications Research Service, Arlington, Va.
LASING OF XeCl, Xe and KrF EXCIMER MOLECULES IN TWO-COMPONENT MIXTURES Abstract Only
N. G. Zubrilin, A. I. Milanich, M. P. Chernomorets, and S. V. Yurchuk *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 16 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 643-644 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22270# Joint Publications Research Service, Arlington, Va.
HIGH-POWER CO2 ELECTRIC DISCHARGE LASER WITH EASILY IONIZED SUBSTANCES ADDED Abstract Only
V. V. Apollonov, Yu. M. Vaskovskiy, M. I. Zhavoronkov, A. M. Prokhorov, R. Ye. Rovinskiy, V. Ye. Rogalin, N. D. Ustinov, K. N. Firsov, I. S. Tsenina, and V. A. Yamshchikov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 17 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 5-9 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22271# Joint Publications Research Service, Arlington, Va.
GENERATION OF PICOSECOND PULSES IN MONOPULSE-PUMPED DYE LASERS Abstract Only
K. D. Yegorov, V. M. Petnikova, S. A. Pleshanov, and V. V. Shuvalov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 18 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 41-47 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22272# Joint Publications Research Service, Arlington, Va.
SPATIAL, TEMPORAL AND ENERGY CHARACTERISTICS OF COPPER-VAPOR LASER RADIATION Abstract Only
V. P. Belyayev, V. V. Zubov, A. A. Isayev, N. A. Lyabin, Yu. F. Sobolyev, and A. D. Chursin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 19 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 74-79 Original language document was announced in IAA as A85-26231 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22273# Joint Publications Research Service, Arlington, Va.
COMPARATIVE ANALYSIS OF OPTICALLY AND ELECTRONICALLY PUMPED BROADBAND EXCIMER LASERS Abstract Only
G. Marovski, A. V. Kanayev, L. D. Mikheyev, and D. B. Stavroskiy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 20 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 180-183 Original language document was announced in IAA as A85-26240 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22274# Joint Publications Research Service, Arlington, Va.
SINGLE-FREQUENCY CW LASING IN INJECTION LASER BASED ON TERRACED HETEROSTRUCTURE WITH EXTERNAL DISPERSION CAVITY Abstract Only
A. P. Bogatov, I. C. Goldobin, P. G. Yeliseyev, O. G. Okhotnikov, G. T. Pak, M. P. Rakhvalskiy, Ye. G. Faynboym, and K. A. Khayretdinov *In its* USSR Report: Physics and Mathematics (JPRS-UPM86-003) 5 Feb. 1986 p 21 Transl. into ENGLISH from KVantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 162-164 Original language document was announced in IAA as A85-26237 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22275# Joint Publications Research Service, Arlington, Va.
WAVELENGTH SWITCHING IN COPPER-VAPOR LASERS Abstract Only
S. A. Zenchenko, V. I. Ivanov, I. A. Malevich, and S. F. Shulekin N its USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 22 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 196-197 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22276# Joint Publications Research Service, Arlington, Va.
H2/F2 CHEMICAL LASER INITIATED BY EXCIMER FLASHLAMP Abstract Only
Ye. V. Gordon, V. I. Matyushenko, V. S. Pavlenko, and V. D. Sizov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 23 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 220-223 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22277# Joint Publications Research Service, Arlington, Va.
YAG:Er3+ CROSS-RELAXATION LASER Thesis - USSR Academy of Sciences, 1984 Abstract Only
Vladimir Andreyevich Lobachev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 24 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-21850* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AUTOMATED WELD TORCH GUIDANCE CONTROL SYSTEM Patent
Hubert E. Smith, William A. Wall, and Morrison R. Burns, Jr., inventors (to NASA) Issued 28 Jan. 1986 9 p Filed 27 Dec.

1984 Continuation-in-part of US-Patent-Appl-SN-460733, filed 25 Jan. 1983, abandonded
(NASA-Case-MFS-25807-2; US-Patent-4,567,348;
US-Patent-Appl-SN-685607; US-Patent-Class-219-124.34;
US-Patent-Class-318-577; US-Patent-Class-358-101;
US-Patent-Class-901-42; US-Patent-Class-901-47) Avail: US Patent and Trademark Office CSCL 13I

A device for automatically controlling the movement of a welding torch while welding an elongated joint is described. A charge injection television camera is carried on a movable support. The camera includes a matrix of individual light sensing video elements which generate voltages responsive to light reflected off of the joint and surrounding areas of the work piece. The voltages produced by the pixels are converted to digital words which are fed to a microprocessor for generating an error signal. This error signal is fed to a digital motor which is used to drive a movable support upon which the television camera is carried.
Official Gazette of the U.S. Patent and Trademark Office

N86-21851 Stanford Univ., Calif.
INFLUENCE OF GROWTH CONDITIONS ON THE STRUCTURE AND PROPERTIES OF COBALT AND COBALT CHROMIUM THIN FILMS Ph.D. Thesis
Joyce Anne Thompson 1985 293 p
Avail: Univ. Microfilms Order No. DA852236

The influences of the sputter deposition and growth conditions on the structure and properties of cobalt and cobalt alloy thin films were investigated with particular emphasis on the magnetic properties of interest for magnetic recording storage media. They were deposited by RF sputtering, and the relationships between growth conditions, film structure, and magnetic properties were investigated. The sputtering parameters having the greatest influence on film properties are the target voltage, substrate bias, and sputter cleaning of the substrates prior to deposition. Thermal effects were shown to be very important in determining film properties. The key influences of various substrates are their effective thermal mass and substrate surface finish. Oxygen stabilizes the hexagonal structure in preference to the cubic structure in pure cobalt, and coercivities increase as oxygen content increases, for cobalt, cobalt-chromium, and also cobalt-titanium. Both cobalt and cobalt-chromium are modeled with a grain structure consisting of a core of more magnetic material surrounded by a periphery of less magnetic material. Dissert. Abstr.

N86-21852 Stanford Univ., Calif.
EXPERIMENTS ON THE END-POINT POSITION CONTROL OF A VERY FLEXIBLE ONE-LINK MANIPULATOR Ph.D. Thesis
Eric Schmitz 1985 239 p
Avail: Univ. Microfilms Order No. DA8522225

An experiment was constructed to demonstrate control strategies for the next generation of fast-moving and lightweight industrial robots as well as for future manipulators for space applications; it consists of a one link, one meter long, very flexible manipulator in which the position of one end (tip) is to be sensed and precisely positioned by torquing a the other end. The arm is moving and bends freely in the horizontal plane but is stiff in torsion and vertical bending. For such a situation, where the sensor used for feedback and the actuator are separated by a flexible structure (non-colocation), the problem of achieving stability is severe. After a description of the dynamic modelling of the arm and of the experimental apparatus, the application of classical and modern control design techniques to the design of a tip position controller is discussed. Dissert. Abstr.

N86-21853 Virginia Polytechnic Inst. and State Univ., Blacksburg.
EXPERIMENTAL-THEORETICAL STUDY OF VELOCITY FEEDBACK DAMPING OF STRUCTURAL VIBRATIONS Ph.D. Thesis
Gary Robert Skidmore 1985 109 p
Avail: Univ. Microfilms Order No. DA8521353

The active damping of structural vibrations through the application of various forms of velocity feedback control is studied. Active damping will be required for large space structures which are performance-sensitive to motion or inaccurate pointing. Several control forms, including modal-space active damping and direct rate feedback are analyzed theoretically, and three laboratory models are described. A previous, unsuccessful attempt at control is reviewed and explained. The remaining control forms developed in the theoretical section were implemented successfully and the results compare favorably with theoretical predictions. Each control form is analyzed relative to its own merits and in comparison with other methods. An important point is the stability assured by a dual (colocated) configuration of velocity sensors and control force actuators. Modal-space active damping is shown to be an effective control method with predictable performance in controlled modes and beneficial spillover into residual (noncontrolled) modes. Dissert. Abstr.

N86-21854 State Univ. of New York, Stony Brook.
CHARACTERIZATION OF PLASMA-SPRAYED FERRITE COATINGS Ph.D. Thesis
Bijay S. Saha 1985 282 p
Avail: Univ. Microfilms Order No. DA8518361

Ferrite coatings based on the system Fe2O3-BaO-CoO were investigated. The microstructural and crystallographic studies of the coatings were carried out, employing scanning electron microscope, transmission electron microscope, and X-ray diffraction. The magnetic properties were examined by ferrimagnetic resonance and d.c. magnetic measurements. The effects of oxygen, both during plasma spraying and upon subsequent heat treatment in oxygen, were investigated. The magnetic domain structure of the coatings and thin films formed by the evaporation of coating and powder materials was examined. Dissert. Abstr.

N86-21855*# National Aeronautics and Space Administration, Washington, D.C.
COMBUSTION ENGINE FOR SOLID AND LIQUID FUELS
W. Pabst Mar. 1986 10 p Transl. into ENGLISH of West German Patent no. P34-40-370.1 (5 Nov. 1984) p 1-8 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77714; NAS 1.15:77714) Avail: NTIS HC A02/MF A01 CSCL 13I

A combustion engine having no piston, a single cylinder, and a dual-action, that is applicable for solid and liquid fuels and propellants, and that functions according to the principle of annealing point ignition is presented. The invention uses environmentally benign amounts of fuel and propellants to produce gas and steam pressure, and to use a simple assembly with the lowest possible consumption and constant readiness for mixing and burning. The advantage over conventional combustion engines lies in lower consumption of high quality igniting fluid in the most cost effective manner. Author

N86-21856*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUASI-MODAL VIBRATION CONTROL BY MEANS OF ACTIVE CONTROL BEARINGS
Kenzou Nonami and David P. Fleming [1986] 12 p refs To be presented at the International Conference on Rotordynamics, Tokyo, Japan, 14-17 Sep. 1986; sponsored in part by IFTOMM, and the Japan Society of Mechanical Engineers
(NASA-TM-87232; E-2899; NAS 1.15:87232) Avail: NTIS HC A02/MF A01 CSCL 13I

This paper investigates a design method of an active control bearing system with only velocity feedback. The study provides a new quasi-modal control method for a control system design of an active control bearing system in which feedback coefficients are determined on the basis of a modal analysis. Although the number of sensors and actuators is small, this quasi-modal control method produces a control effect close to an ideal modal control. Author

N86-21857*# Shaker Research Corp., Latham, N.Y.
TURBOMACHINERY INCIPIENT FAILURE DYNAMIC DETECTION INDICATORS AND ANALYSIS Final Report, May 1982 -

Nov. 1983
D. R. Faby, R. L. Smith, and J. L. Frarey Aug. 1985 54 p
(Contract NAS8-34683)
(NASA-CR-178739; NAS 1.26:178739; MTI-85TR17) Avail: NTIS HC A04/MF A01 CSCL 13I

Tape recorded signals from case-mounted accelerometers are examined to determine the feasibility of detecting spalls on bearing balls in the liquid oxygen (LOX) pump in the Space Shuttle Main Engine (SSME). The nonperiodic nature of the spall impact on inner and outer bearing races caused traditional techniques to be unsuccessful. A technique involving statistical techniques and spectra ratios was used to review available pump test tapes.
Author

N86-21858*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TOOL AND PROCESS FOR EXPLOSIVE JOINING OF TUBES Patent Application
Laurence J. Bement and James W. Bailey, inventors (to NASA) Filed 23 Oct. 1985 14 p
(NASA-Case-LAR-13309-1; NAS 1.71:LAR-13309-1;
US-Patent-Appl-SN-790597) Avail: NTIS HC A02/MF A01 CSCL 13I

The invention is a tool and process to be used in explosive joining of tubes. The tool consists of an inititator, a tool form and a ribbon explosive. The assembled tool is a compact, storable and safe device suitable for explosive joining of small, lightweight tubes down to 0.20 inch in diameter. The invention is inserted into a tube to be welded which tube has itself been inserted into either another tube or a tube plate. A shim or standoff between the two surfaces to be welded is necessary. Initiation of the explosive inside the tube results in a high velocity, angular collision between the mating surfaces. This collision creates surface melts and collision bonding wherein electron-sharing linkups are formed.
NASA

N86-21859*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SELF-COMPENSATING SOLENOID VALVE Patent Application
Fritz H. Woeller and Yutaka Matsumoto, inventors (to NASA) Filed 7 Nov. 1985 8 p
(NASA-Case-ARC-11620-1; NAS 1.71:ARC-11620-1;
US-Patent-Appl-SN-795945) Avail: NTIS HC A02/MF A01 CSCL 13K

The subject invention relates to a solenoid valve in which both an inlet and an outlet of the valve are sealed when the valve is closed. This double seal compensates for leakage at either the inlet or the outlet by making the other seal more effective in response to the leakage and allows the reversal of the flow direction int he valve by simply switching the inlet and outlet connections. Solenoid valve has a valve chamber within valve body. Inlet and outlet tubes extend through plate into the chamber. Movable core in a chamber extends into solenoid coil. The distal end of the core has a silicone rubber plug. Other than when the solenoid is energized, compressed spring biases the core downward so that the surface of the plug is in sealing engagement with ends of the tubes. Any leak at the ends increases pressure in the chamber, resulting in increased sealing force of the plug against the other end. Flow direction through the valves is easily reversed by changing connections to the tubes.
NASA

N86-21860# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
MACHINABILITY DATA BASES FOR METAL CUTTING Final Technical Report
Walter W. Olson Sep. 1985 31 p
(AD-A161646; AD-E440303; ARLCB-TR-85030) Avail: NTIS HC A03/MF A01 CSCL 13/8

Machinability date bases are discussed with respect to content, form and methods. Machinability data is needed to implement the factory of the future. Therefore, data sources and current formulas are featured in addition to formation of structures.
GRA

N86-21861# North Carolina State Univ., Raleigh.
PERFORMANCE COMBUSTION CHARACTERISTICS AND EXHAUST EMISSION OF A DIRECT INJECTION DIESEL ENGINE USING WATER/OIL EMULSIONS AS FUEL Final Report, 15 Jan. 1983 - 30 Jun. 1985
E. M. Afify 30 Sep. 1985 106 p
(Contract DAAG29-83-K-0015)
(AD-A161652; ARO-19435.3-EG) Avail: NTIS HC A06/MF A01 CSCL 21/7

A CLR single cylinder diesel engine is used to determine the effect of air content in the emulsified fuel on the performance, exhaust emissions and ignition delay of diesel engines. The effects associated with use of the emulsions on performance, ignition delay and exhaust emissions were determined. The results showed that slight improvement in Brake Specific Fuel Consumption (BSFC) was observed when emulsions with low water content were used at high speeds. For high water content emulsions, the BSFC increased. Heating the intake air increased the BSFC at high engine loads and slightly improved it at low engine loads. While the ignition delay was found to increase with the increase of the water percentage in the emulsion, preheating the air charge was effective in reducing it. Although, NO sub x and soot formation were reduced effectively with the increase of water content in the emulsion, preheating the air charge adversely affected NO sub x and soot emissions. While CO and VHC emissions increased with the increase of the water content in the emulsion, increasing the intake air temperature slightly reduced carbon monoxide and unburned hydrocarbons at low loads.
GRA

N86-21862# Purdue Univ., West Lafayette, Ind. School of Industrial Engineering.
THE SCIENCE OF AND ADVANCED TECHNOLOGY FOR COST-EFFECTIVE MANUFACTURE OF HIGH PRECISION ENGINEERING PRODUCTS. VOLUME 1: AUTOMATED DETECTION AND ERROR COMPENSATION OF NC WORKPIECE POSITION Final Report, 1 Jan. - 31 Dec. 1983
David Noller, Moshe M. Barash, and A. L. Sweet Mar. 1985 215 p
(Contract N00014-83-K-0385)
(AD-A161656) Avail: NTIS HC A10/MF A01 CSCL 13/8

The purpose of the research was to develop methods which will: 1) Locate, by means of a touch-trigger probe, planes and cylinders on a workpiece, 2) Using the location, determine the error between the desired and actual location of the workpiece, and 3) Compensate for the errors so that further machining can take place. In the reported work equations which can fit a plane to the probe measurement by minimizing the sum of the squared errors are used to locate the plane. These equations are well known from linear regression theory. The same principle is used to fit a skewed cylinder to a set of measurements. Using a matrix formulation, expressions for the errors between the fitted surfaces and the desired surfaces are given. These errors are used as the input to two compensation methods: one forces the desired tool/workpiece alignment by using the machine to realign the workpiece, while the other alters the NC program so that subsequent machining operations will be correctly specified. Computer programs to fit surfaces, compute the errors, and accomplish the compensations were developed. Computer runs were made using simulated probe data.
GRA

N86-21863# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
CALIBRATION AND USE OF A LIGHT STRIPE RANGE SENSOR MOUNTED ON THE HAND OF A ROBOT Interim Report
Gerald J. Agin Nov. 1985 20 p
(Contract F33615-83-C-1023; DARPA Order 3597)
(AD-A162441; CMU-RI-TR-85-20) Avail: NTIS HC A02/MF A01 CSCL 17/2

A three-dimensional sensing capability can be very useful in automating the robotic handling of industrial parts. This report describes a sensor that uses a Puma robot to carry a cage in which are mounted a light-stripe projector and a lightweight television camera in fixed relationship to each other. Calculation

of the Cartesian coordinates of all points illuminated by the stripe is a straight-forward matter, provided the positions of the manipulator end point, the camera, and the projector are accurately known. Calibration is necessary to determine these positions. Since the robot itself introduces significant systematic errors, we present a procedure for reducing these errors by recalibration of the zero reference points for each joint. The relative positions of the camera and projector with respect to the robot end-point can be inferred by moving the robot to a selected set of positions and analyzing the images obtained. The ultimate accuracy of the system is a function of the conditions under which it is evaluated. Presently we estimate the worst-case accuracy to be + or - 5 mm.
Author (GRA)

N86-21864# Yale Univ., New Haven, Conn. Dept. of Computer Science.
PLANNING BY SEARCH THROUGH SIMULATIONS
David Miller Oct. 1985 141 p
(Contract N00014-85-K-0301)
(AD-A162470; YALEU/CSD/RR-423) Avail: NTIS HC A07/MF A01 CSCL 12/1

This research is directed towards the creation of automatic planning systems capable of directing the actions of robots in solving realistic tasks. Realistic domains often involve constraints on quantitative issues such as time and cost. In order to produce successful plans, interactions and conflicts between plan steps that involve these quantities must be detected and resolved. The central assumption of this work is that the ordering of tasks, and the sequencing of the plan steps created for their solution, are major and necessary parts of the planning process. The order in which a plan's actions are to be carried out can greatly affect the efficiency and outcome of executing the plan. The actual design of the plan can and should be affected by the ordering of its steps. GRA

N86-21865# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
ACCURATE TRAJECTORY CONTROL OF ROBOTIC MANIPULATORS Interim Report
J. C. VanWinssen and C. W. DESilva Apr. 1985 56 p Sponsored in part by Atlantic Richfield Foundation
(AD-A162561; CMU-RI-TR-85-15) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report presents a control scheme for accurate trajectory following with robotic manipulators. The method uses feedforward control using model-based torques for fast operation and gross compensation, and adaptive feedback control for correcting deviations from the desired trajectory under feedforward control. The adaptive controller eliminates trajectory-following errors in the least squares sense. The control scheme takes into account dynamic nonlinearities (e.g., coriolis and centrifugal accelerations and payload changes), geometric nonlinearities (e.g., nonlinear coordinate-transformation matrices) and physical nonlinearities (e.g., nonlinear damping) as well as dynamic coupling in manipulators. Computer simulations are presented to indicate the effectiveness and robustness of the control scheme. When the desired trajectory is completely known before the control scheme is implemented, then off-line computations can be used to generate the adaptive feedback gains and the computational efficiency will not be a major limiting factor with this control scheme. If real-time changes in the desired trajectory have to be accommodated, the computational efficiency has to be improved using recursive relations to compute the adaptive gains. The necessary recursive relations are derived and presented in this report. Author (GRA)

N86-21866# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
THE SYNTHESIS OF FORCE CLOSURE GRASPS IN THE PLANE
Van-Duc Nguyen Sep. 1985 48 p
(Contracts N00014-80-C-0505; N00014-82-K-0334)
(AD-A162635; AI-M-861) Avail: NTIS HC A03/MF A01 CSCL 13/5

This paper addresses the problem of synthesizing planar grasps that have force closure. A grasp on an object is a force closure grasp if and only if we can exert, through the set of contacts, arbitrary force and moment on this object. Equivalently, any motion of the object is resisted by a contact force, that is the object cannot break contact with the finger tips without some nonzero external work. The force closure constraint is addressed from three different points of view: mathematics, physics, and computational geometry. The last formulation results in fast and simple polynomial time algorithms for directly constructing force closure grasps. We can also find grasps where each finger has an independent region of contact on the set of edges.
Author (GRA)

N86-21867# Lawrence Livermore National Lab., Calif.
IMPROVEMENTS IN THE WELDABILITY OF A SUPERCONDUCTOR SHEATH MATERIAL
L. T. Summers and J. W. Morris, Jr. Aug. 1985 9 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985 Prepared in cooperation with California Univ., Lawrence Berkeley Lab.
(Contract W-7405-eng-48)
(DE86-000748; UCRL-92346; CONF-850814-27) Avail: NTIS HC A02/MF A01

The effects of chemistry and heat treatment variation on the 4-K tensile properties of A-286, a candidate sheath material for force-cooled superconductors, are investigated. Currently, full use of A-286 and similar superalloys is limited by the observed low yield and ultimate tensile strengths in the welded and aged condition. The low strength is shown to be associated with the formation of precipitate-free zones as a result of alloying-element segregation during weld pool solidification. It has been determined that minor modifications of the weld-metal chemistry by the addition of Ti reduce precipitate-free-zone formation, resulting in matching weld-metal and base-plate strengths at 4 K. Furthermore, nucleation of the (GAMMA)' hardening phase has been found to be a strong function of temperature and composition. Modified heat-treatment schedules have been determined that are amenable to superconductor fabrication and that result in increased weld hardening and improved 4-K tensile properties. DOE

N86-21868# Los Alamos National Lab., N. Mex.
ROBOTIC SAMPLE PREPARATION FOR RADIOCHEMICAL PLUTONIUM AND AMERICIUM ANALYSES
N. Stalnaker, T. Beugelsdijk, A. Thurston, and J. Quintana 1985 5 p ref Presented at the 28th Oak Ridge National Laboratory Conference on Analytical Chemistry, Knoxville, Tenn., 1 Oct. 1985
(Contract W-7405-eng-36)
(DE86-000801; LA-UR-85-3444; CONF-8510151-7) Avail: NTIS HC A02/MF A01

A Zymate robotic system has been assembled and programmed to prepare samples for plutonium and americium analyses by radioactivity counting. The system performs two procedures: a simple dilution procedure and a TTA (xylene) extraction of plutonium. To perform the procedures, the robotic system executes 11 unit operations such as weighing, pipetting, mixing, etc. Approximately 150 programs, which require 64 kilobytes of memory, control the system. The system is now being tested with high-purity plutonium metal and plutonium oxide samples. Our studies indicate that the system can give results that agree within 5% at the 95% confidence level with determinations performed manually. DOE

N86-21869# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FINITE-ELEMENT ANALYSIS OF ADHESIVELY BONDED JOINTS Interim Report
J. N. Reddy and S. Roy Aug. 1985 55 p refs
(Contract N00014-82-K-0185)
(PB86-100708; VPI-E-85-18) Avail: NTIS HC A04/MF A01 CSCL 13E

The report summarizes the technical work performed on the finite-element analysis of adhesively bonded joints. A review of

the literature (30 ref.) is presented, validation of the program VISTA is described, and the theoretical basis of the program NAP2D (developed during the current project) is outlined, and the effect of boundary conditions and finite element meshes on the stress distribution in adhesively bonded joints is investigated. GRA

N86-21870# AiResearch Mfg. Co., Torrance, Calif.
HIGH-TEMPERATURE CERAMIC RECUPERATOR AND COMBUSTION AIR BURNER PROGRAMS: SEAL DEVELOPMENT Report, Apr. 1981 - Oct. 1983
H. Strumpf, D. M. Kotchick, and M. G. Coombs Aug. 1985 83 p
(Contracts GRI-5083-231-0961; GRI-5080-342-0440; GRI-5080-342-0439)
(PB86-105079; Rept-84-21509; GRI-85/0069) Avail: NTIS HC A05/MF A01 CSCL 13H

This report describes part of a comprehensive research effort performed to support the development of a ceramic recuperator and its companion high-temperature preheated combustion air burner. The system is designed to operate in a variety of industrial flue gas streams with exhaust temperatures up to 2500F. The recuperator design required the development of high temperature compliant tube seals and the development of high-temperature compliant shell seals. Seals utilizing ceramic fiber and/or refractory mortar were successfully developed, resulting in air leak rates were below the design limit of 25 cu in/min for each joint. GRA

N86-21871# Trochoid Power Corp., Eden Prairie, Minn.
VOLUMETRIC TROCHOIDAL GAS COMPRESSOR FOR USE AS A HEAT PUMP Final Report, Jan. 1981 - Mar. 1985
R. M. Hoffmann Mar. 1985 127 p
(Contract GRI-5080-342-0389)
(PB86-102720; GRI-85/0026) Avail: NTIS HC A07/MF A01 CSCL 13A

Topics include: design, development, and manufacture of 300 cfm volumetric compressor based on trochoidal geometry. GRA

N86-21872# Mechanical Technology, Inc., Latham, N. Y.
FREE-PISTON STIRLING ENGINE DEVELOPMENT Annual Report, 1 Dec. 1983 - 31 Dec. 1984
T. J. Marusak and R. A. Ackerman Jul. 1985 113 p
(Contract GRI-5082-242-0721)
(PB86-102746; MIT-85FPSE29; GRI-85/0117) Avail: NTIS HC A06/MF A01 CSCL 13A

The Free Piston Stirling Engine/Heat Pump (FPSE/HP) is a heat-actuated heat pump that is being developed for residential applications. The system features an advanced free piston Stirling engine coupled to a Rankine refrigerant compressor through a unique and highly efficient diaphragm-actuated hydraulic transmission. During the past year the program has concentrated on developing the performance of the individual components, and this report presents the progress made. The engine development is being funded by the Gas Research Institute, with the main technical goal of integrating the most advanced, reliable system components into a prototype FPSE heat pump module for laboratory testing and evaluation. GRA

N86-21873# Battelle Columbus Labs., Ohio.
BURNER TECHNOLOGY BULLETIN: CONTROL OF NOx EMISSIONS FROM RESIDENTIAL GAS APPLIANCES
M. J. Murphy and A. A. Putnam Apr. 1985 55 p
(Contract GRI-5082-241-0772)
(PB86-103892; N-4250-1452; GRI-85/0132) Avail: NTIS HC A04/MF A01 CSCL 13A

The status of technology on NOx control for reference by appliance manufacturers is summarized and is intended as a primer for engineering personnel. Information contained the origin of NO and NO2 emissions, typical NO and NO2 emissions from arious types of gas appliances, effects of combustion variables on NOx emissions, methods of NOx reduction, test methods and instrumentation, and conversion factors for various units of measure for NOx emissions. methods discussed include: burner adjustment, flame inserts, staged combustion secondary air baffling, flue gas recirculation and use of radiant catalytic burners. GRA

N86-21874# IIT Research Inst., Chicago, Ill.
CHARACTERIZATION OF EMISSION RATES FROM INDOOR COMBUSTION SOURCES Final Report, Mar. 1982 - Mar. 1985
D. J. Moschandreas, S. M. Relwani, H. J. ONeill, J. T. Cole, and R. H. Elkins Mar. 1985 224 p Prepared in cooperation with Institute of Gas Technology, Chicago, Ill.
(Contract GRI-5081-251-0575)
(PB86-103900; IITRI-C08675-F; GRI-85/0075) Avail: NTIS HC A10/MF A01 CSCL 13A

Indoor air pollution in residences, offices, public access buildings, and the like may be as important a factor to public health as pollution in the outdoors and in indoor-industrial environments. In addition to others, unvented gas appliances are perceived to be sources of indoor nitric oxide (NO) and nitrogen dioxide (NO2). Chamber experiments were performed to measure emission rates of NO, NO2, and CO for range-top burners, range ovens, pilot lights, gas dryers, gas space heaters, and cigarettes. The values evaluated establish the range of emission rates for these constituents under well-conrolled conditions. Emissions of particulate matter, formaldehyde, polynuclear aromatic hydrocarbons, and volatile organic compounds were also measured and found to be low compared to NOx and CO. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-21875# Industrial Quality, Inc., Gaithersburg, Md.
HIGH SENSITIVITY, ONE-SIDED X-RAY INSPECTION SYSTEM Final Report, 20 Nov. 1984 - 20 May 1985
Harold Berger, Y. T. Cheng, and E. L. Criscuolo Jul. 1985 33 p
(Contract N60921-85-C-0056)
(AD-A162567; IQI-R-85-0710; NSWC-TR-85-292) Avail: NTIS HC A03/MF A01 CSCL 14/2

A backscatter X-ray imaging method for nondestructive testing has been developed. The one-sided inspection technique, a slot camera, is much faster in response than previous backscatter methods. Delaminations in graphite-epoxy composites and other low atomic number materials have been detected. Wall thicknesses up to 7 cm thick have been interrogated. The results show the location (depth) and magnitude (separation width) of simulated delaminations throughout the entire wall. A disbond between two flat surfaces in contact has been detected. Feasibility of the system has been shown with film detectors. A fast response electronic detector is proposed. The objective of this program was to demonstrate the feasibility of an X-ray inspection equipment capable of probing an inspection sample from only one side to detect delaminations, voids, cracks or foreign material through the thickness interrogated. The feasibility of a unique, patented X-ray slot camera that works by scattered radiation was demonstrated using film techniques. The unique capability of this slot camera is that it can obtain images of the internal structure of an object at depths of many centimeters (depending on the object density and the X-ray energy) with a sensitivity that is several orders of magnitude greater than past-developed scattered radiation cameras. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-21876 British Library Lending Div., Boston Spa (England).
ESTIMATION OF THE HIGH TEMPERATURE LOW CYCLE

FATIGUE STRENGTH OF WELDED JOINTS. 1: PROPOSAL OF FUNDAMENTAL ESTIMATION METHODS
I. Nonaka, M. Kitagawa, and A. Otomo 2 Dec. 1985 19 p refs Transl. into ENGLISH from Ishikawa-Harima Engineering Review (Japan), v. 22, pt. 2, 1982 p 103-107
(BLL-Risley-Tr-5236-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Two basic estimation methods for the high temperature, low cycle fatigue strength of welded joints are described. In both of these methods the base metal and the weld metal constituting the joint are treated as two independent factors and the fatigue life of the welded joint is predicted by means of previously obtained basic data for these, i.e., fatigue curves and cyclic stress/strain curves. The first estimation method predicts fatigue life on the basis of the value of the stress imposed; the second, on the basis of the mean strain. Prediction values for these methods were compared with experimental results from low cycle fatigue tests performed on welded joints in heating tubes of SUS 316 steel and 2 1/4 Cr - 1 Mo steel. The effect of post-weld heat treatment on the accuracy of the prediction is also considered.
M.G.

N86-21877 British Library Lending Div., Boston Spa (England).
EVALUTION OF LOW CYCLE FATIGUE STRENGTH OF WELDED JOINTS AT ELEVATED TEMPERATURE: APPLICABILITY OF METHODS OF EVALUATION AND PLASTIC RESTRAINT
Isamu Nonaka, Masaki Kitagawa, and Akira Otomo Nov. 1985 19 p refs Transl. into ENGLISH from Ishikawajima Harima Technology Report (Japan), v. 23, no. 6, Nov. 1983 p 515-520 (BLL-Risley-Tr-5237-(9091.9F); Rept-2) Avail: British Library Lending Div., Boston Spa, Engl.

The applicability of a method to predict fundamental fatigue strengths proposed in an earlier report is discussed. The effect of plastic restraint due to the difference in the cyclic deformation resistances of the parent material and the weld metal on the accuracy of predicted fatigue life expectancies is determined. An FEM analysis was carried out in order to evaluate the plastic restraint quantitatively; fatigue life expectancy predictions were also made on the basis of the FEM analysis. In this case 304 stainless steel welded joints and 2 1/4Cr-1Mo steel welded joints which had different plastic restraints were used for the test materials and the proportion of weld metal in the gauge length was varied.
M.G.

N86-21878 Wyoming Univ., Laramie.
MODIFIED FINITE STRIP METHOD WITH SPLINE FUNCTIONS Ph.D. Thesis
Jui-Lin Chen 1985 126 p
Avail: Univ. Microfilms Order No. DA8517853

An alternative method of finite strip is developed for the analysis of irregular elastic thin plates. The conventional method of finite strip is a powerful method for problems defined in rectangular regions. This modified finite strip method is developed for deflection, bending, vibration and stability analysis of irregular plates using spline functions in the y-direction instead of trigonometric series. Using the finite strip method with spline functions, nonrectangular, irregularly-shaped two dimensional problems can be investigated. An algorithm for large eigenvalue problems is also written to solve the natural frequencies and buckling factors by computer programming. Numerical examples showed that the new method is superior to the finite element method in computational labor. Confirmatory runs were made against the classical method for square plates. Displacement, moment, vibration and buckling of nonrectangular plates, including trapezoidal and polygonal plates, were investigated using this alternative method of finite strip.
Dissert. Abstr.

N86-21879 Dayton Univ., Ohio.
SHOCK FRACTURE AND RECOMPACTION OF CERAMICS Ph.D. Thesis
Dan Yaziv 1985 174 p
Avail: Univ. Microfilms Order No. DA8523960

A comprehensive model for shock fracture of ceramics was developed. Plate impact experiments were conducted. The dynamic target response was measured. Three commercial ceramics were employed, alumina Al-300, alumina AD-85 and to a lesser extent, beryllia Ceralloy 418. A double impact technique for studying the properties of shock-damaged materials was developed. The first impact causes pall in the target while the second impact recompacts the target. Analysis of the transmitted waves gives the properties of the damaged region. A self trap recovery technique was developed to examine spalled targets. Examination of the recovered targets, as well as the timing of spall signals has led to a spall zone model, in which spall occurs not at a plane but in a finite region. The Hugoniot Elastic Limit (HEL) of 6.5 mm thick Al-300 is 8 GPa. The HEL of AD-85 decays from 5.9 GPa in 6.4 mm thick samples to 4.1 GPa in 20.4 mm. This decay partially explains the discrepancy between static and dynamic strength measurements. Above the HEL all three materials fractured in compression. Spall toughness in brittle materials was defined and evaluated.
Dissert. Abstr.

N86-21880 Brown Univ., Providence, R. I.
SHEAR STRESS CONCENTRATION NEAR THE EDGE OF A THIN FILM DEPOSITED ON A SUBSTRATE Ph.D. Thesis
Wei Yang 1985 135 p
Avail: Univ. Microfilms Order No. DA8519932

The shear stress concentration near the edge of a thin film attached to a deformable substrate is studied. Chapter 1 outlines the basic mechanical analysis for film deposition. An integral differential equation is derived to govern the film stretching force. The general structure suggests that the bonding shear stress exhibits a square root singularity at the film edge. In chapter 2, a general discussion of the thermal differential strain which results from film deposition from a melt is presented. Chapter 3, 4 and 5 are devoted to the solution techniques of the Prandtl equation. The simplest case of deposition of a slender, non-interactive and uniform film is attacked by means of Mellin transforms and the significant influence of the deposition process on nondimensional stress intensity factor k is revealed. Chapters 6 and 7 are devoted to discussion of research on more sophisticated film models, including effects of viscosity, creep and plasticity. For polymeric films, the stress intensity factor histories are traced for several different visco-elastic film models. The fictitious singular bonding stress near film edge is removed in the last chapter by admitting relative slip between the film and substrate. Dissert. Abstr.

N86-21881 Northwestern Univ., Evanston, Ill.
PLASTIC DEFORMATION ON THE CRACK LINE IN AN ELASTIC PERFECTLY-PLASTIC MATERIAL Ph.D. Thesis
Zailiang Li 1985 114 p
Avail: Univ. Microfilms Order No. DA8523555

For rapid crack propagation in an elastic perfectly-plastic material, explicit expressions have been obtained for quasi-static and steady-state dynamic strains on the crack line, from the moving crack tip to the moving elastic-plastic boundary. The method of solution uses power series in the distance to the crack line, with coefficients which depend on the distance to the crack tip. Substitution of the expansions in the equations of motion, the yield condition (Huber-Mises) and the stress-strain relations yields a system of nonlinear ordinary differential equations for the coefficients. These equations have been solved rigorously for Mode 3, and in an approximate manner for Mode-I plane stress. The crack-line fields have been matched to appropriate elastic fields at the elastic-plastic boundary. In conjunction with the crack growth criterion the expressions for the strain on the crack line to an integral equation for the size of the plastic zone as a function of the crack length, for both the Mode-3 and the Mode-I plane stress quasi-static crack propagation problems. A relation between the plastic zone size and the remote elastic yield yields resistance curves.
Dissert. Abstr.

N86-21882 Northwestern Univ., Evanston, Ill.
ELASTODYNAMIC SCATTERING BY PERIODIC SURFACE INDENTATIONS Ph.D. Thesis
Ronald Allen Roberts 1985 230 p
Avail: Univ. Microfilms Order No. DA8523578

Scattering of an incident elastodynamic field by an array of periodically spaced indentations contained in the otherwise plane surface of an elastic half space is investigated both theoretically and experimentally. This work is intended for application in Quantitative Nondestructive Evaluation (QNDE), and employs ultrasonic QNDE experimental techniques. The theoretical modelling includes often overlooked features of the experimental reality, such as the beam profile and temporal response of the ultrasonic transducer. An emphasis is placed on signal processing. Both the direct and inverse scattering problems are addressed. The problem for a finite number of adjacent scattering indentations is theoretically formulated as a boundary integral employing the two dimensional Green's function for an elastic half space. The resulting coupled singular integral equations for the displacements on the indented surface are regularized by isolating all singular and near singular terms from the kernels. A rigorous numerical solution is then employed. The boundary integral formulation for scattering by an infinite number of adjacent surface indentations for plane wave incident, is extended to model a finite width incident ultrasonic beam. Dissert. Abstr.

N86-21883# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
VIBRATION DAMPING 1984 WORKSHOP PROCEEDINGS Summary Report, Feb. 1978 - Feb. 1984
Lynn Rogers, ed. Nov. 1984 872 p refs Workshop held in Long Beach, Calif., 27-29 Feb. 1984
(AF Proj. 486U)
(AD-A152547; AFWAL-TR-84-3064) Avail: NTIS HC A99/MF E03 CSCL 20/11

Vibration damping workshop proceedings are presented. Subjects presented include: mechanical properties of polymers, experimental methods, damping in metal matrix composites, friction damping, design of damping structure, modal damping values, and applications of damping. For individual titles, see N86-21884 through N86-21931.

N86-21884# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
SOME MUSINGS ON HOW TO MAKE DAMPING A CREATIVE FORCE IN DESIGN
James W. Mar *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 21 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Ways are suggested to make damping a complete technology, to become a creative force in structural design. The following examples are cited: (1) invention of mechanisms to enhance and control damping; (2) testing of structural joints in simulated zero-g; (3) measurement of material damping without aerodynamic forces; and (4) testing of structures in the zero-g and high vacuum of space. E.A.K.

N86-21885# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
FRACTIONAL CALCULUS TO REPRESENT COMPLEX MODULUS **c64**
Lynn Rogers *In its* Vibration Damping 1984 Workshop Proceedings Nov. 1984 4 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Equations were extracted which summarize developments in use of operators and fractional derivatives. The equations unify and extend capability in viscoelasticity. Adaptation of the integer order Maxwell model to the fractional case gives a related representation. Properties other than complex modulus are expressed through interconversion based on the integer order factored polynomial approximation to equation. E.A.K.

N86-21886# Universal Energy Systems, Inc., Dayton, Ohio.
COMPLEX MODULUS BEHAVIOR OF A VISCOELASTIC ADHESIVE MEASURED AT HARMONIC STRAIN AMPLITUDES OF 10-10
T. J. Lagnese and D. I. G. Jones (AFWL, Wright-Patterson AFB, Ohio) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 16 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The complex modulus behavior of a viscoelastic material, measured by a dynamic stiffness method, was determined at several low excitation levels and temperatures. The effect of strain amplitude is demonstrated. It is found that the complex modulus of the viscoelastic adhesive does not depend on strain amplitude at cyclic levels as low as 10E-10m/m. E.A.K.

N86-21887*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
EXPERIMENTAL MEASUREMENT OF MATERIAL DAMPING FOR SPACE STRUCTURES **c18**
Edward F. Crawley and Raymond L. Sheen *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 18 p refs Sponsored in part by US Air Force (For primary document see N86-21883 12-39)
(Contract NAGw-21)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A procedure for the measurement of material damping is described. The free decay of free-free beams, when lofted into free fall in vacuum, was recorded. Tests were performed on aluminum, graphite/epoxy, and graphite/magnesium metal matrix materials. Specimens with a fundamental free-free frequency below the elaxation frequency showed a higher level of damping and of stress dependence than predicted. For [0] sub 8 laminates, a material damping ratio of 0.00055 was found for fequencies varying from 45 Hz to 237 Hz. The damping was neither stress nor frequency dependent. For [90] sub 8 laminates, the damping ratio ranged from 0.0055 to 0.0066 as frequency ranged from 42 Hz to 143 Hz. Damping ratios for [90] sub 8 specimens were independent of stress. Experimentally measured damping ratios for metal matrix specimens with unidirectional graphite fibers, magnesium matrix, and either titanium or magnesium foil, ranged from .00039 to .00099, depending upon the matrix material, frequency, and possibly the stress range involved. E.A.K.

N86-21888# General Motors Corp., Indianapolis, Ind. Gas Turbine Operations.
DAMPING APPLICATIONS IN TURBINE ENGINES **c07**
R. L. Jay and D. W. Burns *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 23 p ref (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The application of damping treatments to turbomachinery rotating and static components based on measured response characteristics of compressor and turbine stages was evaluated. Data from a shrouded fan stage, an integral turbine stage, and two stator vane assemblies were used. The contributions due to material damping, interface damping and aerodynamic damping comprising the total system damping were identified. A basis for the application of damping treatments which can be effective in controlling resonant response amplitudes is established. E.A.K.

N86-21889# United Technologies Research Center, East Hartford, Conn. Applied Mechanics Research.
CHARACTERISTICS OF DRY FRICTION DAMPING
A. V. Srinivasan, B. N. Casenti, and D. G. Cutts *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 30 p refs (For primary document see N86-21883 12-39)
(Contract F49620-83-C-0076)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The problem of estimating damping due to dry friction forces induced at interfaces of vibrating components is summarized. The complex processes involved during rubbing of one component relative to another bringing into play a host of parameters are

indicated. Limited data are available in regard to dry friction in a vibratory environment. E.A.K.

N86-21890# Stress Technology, Inc., Rochester, N.Y.
DAMPING PROPERTIES OF STEAM TURBINE BLADES c07
Neville F. Rieger *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 31 p refs Sponsored in part by the Electric Power Research Inst. (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Material hysteresis, attachment friction and gasdynamic effects are recognized sources of damping in turbomachinery blading. The damping properties of several types of steam turbine blades were examined. One objective was to determine the relative contributions from the damping sources in these blade types. A nonrotating damping test rig which used real blades mounted in corresponding real disk root attachments was used. The rig and the test program are described. The blade damping properties conform to effects associated with material hysteresis damping. For the blades the influence of friction in the attachment region was negligible for test loads and vibratory amplitudes encountered in practice. Gasdynamic damping from the surrounding medium was studied in an environmental chamber and was found to be negligible. A small level of gasdynamic damping from fluid working appears to be possible for blades under operating loads. E.A.K.

N86-21891*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONCEPTS AND EFFECTS OF DAMPING IN ISOLATORS
James Kerley *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 14 p (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20K

A series of innovative designs and inventions which led to the solution of many aerospace vibration and shock problems through damping techniques is presented. The design of damped airborne structures has presented a need for such creative innovation. The primary concern was to discover what concepts were necessary for good structural damping. Once these concepts are determined and converted into basic principles, the design of hardware follows. The following hardware and techniques were developed in support of aerospace program requirements: shipping containers, alignment cables for precision mechanisms, isolation of small components such as relays and flight instruments, isolation for heavy flight equipment, coupling devices, universal joints, use of wire mesh to replace cable, isolation of 16-dB, 5000 lb horn, and compound damping devices to get better isolation from shock and vibration in a high steady environment. E.A.K.

N86-21892# Carnegie-Mellon Univ., Pittsburgh, Pa.
RESEARCH ON FRICTION DAMPING IN JET ENGINES AT CARNEGIE-MELLON UNIVERSITY c07
J. H. Griffin and J. Bielak *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 12 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC 99/MF A01 CSCL 20/11

Research on friction damping in jet engines is discussed. Topics include: (1) mistuning/friction interaction, (2) flutter stabilization, (3) the use of the finite element method to calculate the forced response of structures containing friction interfaces, and (4) improved methods for modeling friction. E.A.K.

N86-21893# Imperial Coll. of Science and Technology, London (England).
FRICTION DAMPING STUDIES AT IMPERIAL COLLEGE
C. F. Beards *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 6 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Force transfer by friction between joint elements, energy dissipation mechanisms, friction damping in joints and the effects of increased joint damping on the vibration response of structures are discussed. The source of damping-inherent structural damping which originates in the joints is investigated. E.A.K.

N86-21894# Martin Marietta Aerospace, Denver, Colo. Aerospace Div.
A DERIVATION OF EQUIVALENT LINEAR VISCOUS AND ELASTIC CONSTANT FOR VISCOELASTIC MATERIALS
S. R. Dahl and R. B. Rice *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 8 p (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A testing method to directly measure the hysteresis characteristics of a viscoelastic material for shear displacement was devised. Three commonly available materials were tested over a frequency range of 0.1 to 100 Hz. Though the materials are essentially nonlinear, linear elastic and viscous damping parameters were approximated using an equivalent energy approach valid for specific frequencies and amplitudes. The linearized parameters can be used in linear structural and control systems analysis programs for the analysis of structures with distributed discrete passive damping mechanisms. E.A.K.

N86-21895# Florida Univ., Gainesville. Dept. of Engineering Sciences.
COMPOSITE MATERIAL DAMPING USING IMPULSE TECHNIQUE
C. T. Sun, B. T. Lee, and S. K. Chaturvedi (Missouri Univ., Rolla) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 23 p refs (For primary document see N86-21883 12-39) (Grant AF-AFOSR-0154-83)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The impulse technique for measuring the internal damping of composite materials is presented. Some improvements were made to gain confidence on the experimental data measured from this technique. The improvements involve the following: (1) replace a contact probe by a noncontact probe; (2) use an amplifier to reduce the noise level; (3) use a spring to control the magnitude, location and dwelling time of the applied force; and (4) use zooming technique to obtain more accurate data. E.A.K.

N86-21896# Naval Surface Weapons Center, Silver Spring, Md.
IMPROVED EXTENSIONAL MODULUS MEASUREMENTS FOR POLYMERS AND METAL MATRIX COMPOSITES
Walter Madigosky *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 11 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

An improved resonance apparatus for rapid and reliable materials characterization is described. The apparatus determines the propagation constants of an extensional acoustic wave by exciting a bar of material at one end by a noise source while the other is allowed to move freely. Miniature accelerometers measure the accelerations at the two locations. A dual channel Fast Fourier Transform (FFT) spectrum analyzer is used to obtain the amplitude and phase response as a function of frequency from which the complex Young's modulus can be obtained. Young's modulus and loss factor measurements were measured in materials ranging from soft polymers to rigid metal matrix composites. For viscoelastic materials the method of fractional derivative is found to successfully model the complex modulus throughout the transition region. It is suggested that the four independent constants used are related to the measurable physical properties and chemical composition of the material. E.A.K.

N86-21897# Manhattan Coll., New York. Dept. of Mechanical Engineering.
MATERIAL DAMPING OF CARBON/EPOXY COMPOSITES BY MEANS OF FREE-FREE BEAM RESONANCE TESTS c24
Daniel W. Haines *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 16 p refs Sponsored in part by the Celanese Corp. (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A testing program which characterizes the principal (0 deg

and 90 deg) damping properties of unidirectional composites incorporating Celion carbon is presented. Data for 0/ + or - 45/90s specimens are also presented. The free-free beam resonance tests eliminate errors introduced by support conditions. This test method enables the determination of Young's moduli and the shear modulus in the plane of bending. E.A.K.

N86-21898# Idaho Univ., Moscow.
IMPROVEMENT OF DAMPING IN FIBER REINFORCED POLYMER COMPOSITES c24
R. F. Gibson, S. A. Suarez, and L. R. Deobald *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 20 p refs (For primary document see N86-21883 12-39)
(Grant AF-AFOSR-0156-83)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Damping in aligned discontinuous fiber reinforced polymer composites was studied to verify a previously developed theoretical model, which predicted that discontinuous fiber reinforcement should enhance the shear-induce linear viscoelastic damping effect in the polymer matrix material. Data for graphite/epoxy and aramid/epoxy composites show that very low fiber aspect ratios are required to produce significant improvements in damping, and that damping also increases markedly with increasing vibration frequency at these low aspect ratios. E.A.K.

N86-21899# Naval Surface Weapons Center, Silver Spring, Md.
DYNAMIC MECHANICAL PROPERTIES OF GRAPHITE/ALUMINUM WIRES AT AUDIOFREQUENCIES c24
Gilbert F. Lee and Clifford W. Anderson *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 15 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Twenty graphite/aluminum wires showed voids due to poor impregnation of aluminum in the graphite fibers. The dynamic mechanical properties of these wires were determined. It was found that the dynamic mechanical properties correlated with the X-ray results. The following properties were determined at room temperature: torsional properties, logarithmic decrement and shear modulus at approximately 0.5 Hz and flexural properties, logarithmic decrement and bending stiffness over a frequency range of 10 to 500 Hz. Torsional results, showed that good impregnated wires have logarithmic decrements less than 0.6 dB and shear moduli greater than 1.3 x 10 to the 10th power Pa while poorly impregnated wires have logarithmic decrements greater than 2.0 dB and shear moduli less than 0.9 x 10 to the 10th power Pa. The flexural results showed that good impregnated wires have logarithmic decrements less than 1.1 dB and bending stiffnesses greater than 1.3 x 1/1000 Pa m sub 4, while poorly impregnated wires have logarithmic decrements greater than 1.1 dB and bending stiffnesses less than 1 x 1/1000 pa-m sub 4. The two nondestructive methods are viable means of investigating the effects of poor aluminum impregnation on the dynamic mechanical response of graphite reinforced aluminum precursor wires. E.A.K.

N86-21900# Martin Marietta Aerospace, Denver, Colo.
DAMPING BEHAVIOR OF METAL MATRIX COMPOSITES c24
M. S. Misra and P. D. LaGreca *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 12 p refs Sponsored in part by Martin Marietta Aerospace (For primary document see N86-21883 12-39)
(Contract F33615-82-R-3222A)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Discontinuous and continuous fiber reinforced composites were evaluated for their damping capacities and elastic moduli. In the case of Gr/Al and Gr/Mg, the damping factor increases significantly in the transverse direction and slightly in the longitudinal direction whereas the longitudinal elastic modulus of the composite has increased by a factor of 3 or more. The damping behavior of the SiC particulate reinforced aluminum composite was similar to that of the matrix aluminum alloy. The observed behavior to the fiber matrix and the diffusion bonded interface present in these compositely are explained. If the interface strength is higher than that of the matrix alloy, the damping capacity remains the same. However, if the interfaces are the weaker areas the damping capacity increases. E.A.K.

N86-21901# National Bureau of Standards, Boulder, Colo. Fracture and Deformation Div.
DAMPING IN METAL-MATRIX COMPOSITES: MEASUREMENT AND MODELING c24
H. M. Ledbetter and S. K. Datta (Colorado Univ., Boulder) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 17 p refs Sponsored in part by DARPA (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Attenuation, alpha of elastic waves in a composite consisting of elastic reinforcing particles dispersed in an elastic matrix was considered. Only geometrical attenuation caused by scattering from particles is discussed. The model contains the effects of particle volume fraction, particle shape, particle size, particle elastic constants, matrix elastic constants, measurement frequency, and elastic-wave polarization. Several assumptions are made concerning the particles: arbitrary-shape ellipsoids (spheres, discs, rods), uniform distribution, random orientation. The model composite is macroscopically both homogeneous and isotropic. Calculations relate only to long wavelengths. A composite consisting of 6061-aluminum-alloy matrix reinforced with 5-micrometer silicon-carbide particles is considered. E.A.K.

N86-21902# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Lab.
DAMPING MEASUREMENT BY DYNAMIC STIFFNESS METHODS
David I. G. Jones and Agnes Muszynska (Bently Rotor Dynamics Research Corp., Minden, Nev.) *In its* Vibration Damping 1984 Workshop Proceedings Nov. 1984 25 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The problem of determining the mass, stiffness and damping parameters of a structure from measured modal response data is addressed. The modal mass shape and damping parameters are determined from both receptance and dynamic stiffness approaches. Complex normal modes are used in the representation of nonproportional damping, localized in specific parts of a structure, whereas real normal modes are sufficient to represent the behavior of a system with damping proportional to stiffness. The inversion of the receptance matrix to obtain the dynamic stiffness matrix, and some unique properties of the elements of the dynamic stiffness matrix, are discussed. Two examples, one from dynamics of a discrete structure and the other for a rotor-bearing system, are presented. E.A.K.

N86-21903*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A COMPARISON OF MEASURED SPACECRAFT MODAL DAMPING VALUES Abstract Only
B. K. Wada and J. C. Chen *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 6 p (For primary document see N86-21883 12-39)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 20K

The prediction and the measurement of modal damping values of spacecrafts for use in the determination of design loads were summarized. Realistic transient forcing functions were used. The solution of complex eigenvalue response solutions resulting from modal synthesis of subsystems in which each subsystem is assigned modal damping values is discussed. Damping data on both the Voyager and the Galileo spacecrafts using up to eight different types of techniques to analyze modal data are presented. It is concluded that it is difficult to estimate the true damping of a structure and the measured damping values which are dependent on the analysis method of the data. E.A.K.

N86-21904# Rockwell International Corp., Downey, Calif.
STRUCTURAL DAMPING OF SHUTTLE ORBITER AND ASCENT VEHICLES c18

D. L. Jensen *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 13 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Experimental structural mode damping factor data are presented for an actual full size vehicle structure. Vibration test programs were conducted during development of the shuttle orbiter vehicle. Average values of structural damping factor range from 0.017 to 0.32 are shown. It is indicated that a primary source of energy dissipation due to air mass displacement is directly dependent on amplitude of motion. A frictional energy loss analysis develops a relation between viscous damping factor and coulomb friction. E.A.K.

N86-21905# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
MEASURED DAMPING OF SHUTTLE ACOUSTIC TEST STRUCTURES **c18**
C. E. Wallace, Mark Mielke, and Jack Joanides (Rockwell International, Downey, Calif.) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 13 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Damping was measured on 10 shuttle structural test specimens which were constructed for acoustic testing. The specimens include the cargo bay doors, the OMS/RCS pod, the wing leading edge section, the wing elevon section, the body flap, the tail section, three fuselage panels and one wing panel. The damping of each natural mode of vibration for each specimen is plotted versus the natural frequency. Statistical analysis, including the mean, standard deviation and probability density for the damping data is presented. It is demonstrated that the damping ratio decreases with increasing frequency and that the logarithm of the damping ratio has a normal distribution. E.A.K.

N86-21906# Southampton Univ. (England). Institute of Sound and Vibration Research.
AVERAGE LOSS FACTORS FOR USE IN STATISTICAL ENERGY ANALYSIS
K. T. Brown and B. L. Clarkson (University Coll. of Swansea, England) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 12 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A new technique for the measurement of frequency band and space averaged loss factors of uniform structural components is described. Values are obtained by an energy measurement technique which gives good results over a wide range of loss factor values. The results can be used in statistical energy analysis prediction programs, or to study the frequency dependence of loss factors in components or materials. E.A.K.

N86-21907# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STRUCTURAL DAMPING POTENTIAL OF WAVEGUIDE ABSORBERS **c32**
Eric E. Ungar and Leonard G. Kurzweil *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 14 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Waveguide absorbers, structural elements that extract energy from vibrating structures in the form of traveling waves, may serve as effective means of vibration reduction. Expressions that indicate how the damping effectiveness of waveguide absorbers attached to structures depend on absorber and structural parameters are presented. Realizations of waveguide absorbers in terms of damped tapered rods and beams are described. Data are presented which illustrate that suitable waveguide absorber installations can provide considerable damping, even of massive structures, with relatively little weight penalty. The damping of a thin plate by a waveguide absorber is compared to that of viscoelastic layer treatments of the same weight. E.A.K.

N86-21908# Hochschule der Bundeswehr, Munich (West Germany). Inst. of Space Technology.
NEW PROPOSED DYNAMIC VIBRATION ABSORBERS FOR EXCITED STRUCTURES
Helmut F. Bauer *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 26 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Space structural systems are very susceptible to oscillations. A liquid damper which consists of a completely filled liquid container filled with two immiscible liquids, in which the motion of the interface is able to effectively dampen the structure is presented. The effectiveness is exhibited for the coupled structure-liquid system. An active motion prevention system is proposed which consists of a control system with a control accelerometer and a cold-gas jet system as a control force. Both systems show good results in preventing structural motion. E.A.K.

N86-21909*# Ohio State Univ., Columbus. Dept. of Engineering Mechanics.
EXTENSIONS OF THE RITZ-GALERKIN METHOD FOR THE FORCED, DAMPED VIBRATIONS OF STRUCTURAL ELEMENTS
A. W. Leissa and T. H. Young *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 21 p (For primary document see N86-21883 12-39)
(Grant NAG3-424)
Avail: NTIS HC A99/MF A01 CSCL 20K

The Ritz-Galerkin methods were used to obtain approximate solutions for free undamped, vibration problems. It is demonstrated that these same methods may be used straightforwardly to analyze forced vibrations with damping without requiring the free vibration eigenfunctions. It was shown that the Galerkin method is an effective technique for these types of problems. The Ritz method has the advantage that it does not need to satisfy the force-type boundary conditions, which is particularly important for plates and shells. Proper functionals representing the forcing and damping terms were developed. Two types of damping--viscous and material (hysteretic) are discussed. Distributed and concentrated exciting forces are treated. Numerical results are obtained for cantilevered beams and rectangular plates. The rates of convergence of the solutions are shown. Approximate solutions from the present methods are compared with the exact solutions for the cantilever beam. E.A.K.

N86-21910# CSA Engineering, Inc., Palo Alto, Calif.
FINITE ELEMENT DESIGN OF VISCOELASTICALLY DAMPED STRUCTURES
Conor D. Johnson, David A. Kienholz, Eric M. Austin, and Michael E. Schneider *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 27 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Four methods for the finite element analysis of structures containing a viscoelastic material are described. These methods fall into the categories of methods for damping treatment selection or methods for response prediction. The Modal Strain Energy (MSE) method is emphasized. The MSE method uses normal mode techniques and is an efficient method for the design of viscoelastically damped structures. The MSE method, implemented by finite element techniques, aids in: (1) selecting the location of the damping treatment; (2) selecting the damping treatment; (3) predicting the modal damping factors; and (4) predicting the responses of the structure. Finite element modeling methods for structures containing viscoelastic materials are discussed. Predicted and measured modal damping and frequencies are compared. E.A.K.

N86-21911# Dayton Univ., Ohio. Research Inst.
ON VIBRATION DAMPING ANALYSIS USING THE FINITE ELEMENT METHOD
R. A. Brockman *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 9 p refs (For primary document see

N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Solution methodology for finite element analysis of problems in vibration damping is described, and several common questions regarding the differences between methods and computer programs are addressed. The discussion focuses on basic questions and principles in the use of finite elements for damping design and analysis. E.A.K.

N86-21912# Dayton Univ., Ohio. Research Inst.
RESULTS OF FINITE ELEMENT ANALYSIS OF DAMPED STRUCTURES
Matthew F. Kluesener *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 11 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A Finite Element Analysis (FEA) was used to model passive damping configurations on integrally damped structures. The modeling of passive damping designs on complex structures poses two problems: (1) the thin damping layers generally result in high aspect ratios of the 3D solid elements representing the damping systems; (2) if a multilayered damping system is modeled, there are a large number of degrees-of-freedom (DOF). Ways to reduce the number of elements representing the damping system and the accuracy of the damping prediction using high aspect ratios are discussed. Tests and corresponding FEA of a double constrained layer damped cantilever plate show that aspect ratios up to 1000:1 yield very accurate results. The experimental FEA comparison also shows that FEA modeling techniques such as using membrane elements for the constraining layers or an equivalent element to represent several layers of the damping system yield good results. E.A.K.

N86-21913# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SEGMENTING AND MECHANICAL ATTACHMENT OF CONSTRAINED VISCOELASTIC LAYER DAMPING TREATMENTS FOR FLEXURAL AND EXTENSIONAL WAVES
Edward M. Kerwin, Jr. and P. W. Smith, Jr. *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 23 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The application of segmented constrained layers to the damping of extensional waves is discussed. There are significant parallels with the flexural wave case; the optimum segment length for a given damping treatment is essentially the same. As with flexural waves, the results apply below an upper frequency limit. Achievable loss factors for extensional waves are lower than for flexural waves for a given system cross section. Mechanical attachment of the constrained-layer damping treatment is sometimes required. Damping performance is compromised to the extent that the constraining layer lateral deflection is inhibited. Quantitative results on the effect of a point fastener are reported. The treatment effective area lost due to a rigid fastener, and a fastener of finite lateral stiffness are examined. The results guide the design of fasteners to minimize their effect on performance. E.A.K.

N86-21914# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Mechanical Engineering.
VIBRATION ISOLATION OF AN ELEVATOR SYSTEM
H.-S. Tzou and A. J. Schiff *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 5 p refs Sponsored in part by the Natioonal Science Foundation (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The vulnerability of an elevator system was demonstrated from recent earthquake reports. An elevator counterweight/frame/guide rails system is modeled by beam finite elements. Because of large structural vibration, parts of the system may come in contact if their relative displacement exceeds the gap. Large dynamic forces which results from contact often cause the damage of the elevator system, the study of viscoelastic damper used as a vibration isolator is introduced. A system with viscoelastic dampers which are modeled by standard linear model is evaluated. E.A.K.

N86-21915# Dayton Univ., Ohio. Research Inst.
DESIGN EVALUATION AND FIELD QUALIFICATION OF A DAMPING SYSTEM FOR AN AUXILIARY POWER UNIT
Michael L. Drake *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 17 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A turbine engine incurred resonant vibration induced fatigue failures in the inlet guide vanes (IGV). High stress levels at frequencies corresponding to the second bending and second torsional resonances were revealed. The operational environment required a damping system to be functional over the temperature range of -50 F to 150 F. The damping system had to survive the high airflow and erosion environment associated with the inlet of the engine and also had to be field installable. A computer aided design procedure was used to develop the required damping design. The final design demonstrated an 86% stress reduction. Engine test stress reductions agreed well with the laboratory results. E.A.K.

N86-21916# LTV Aerospace Corp., Dallas, Tex.
LAMINATED DAMPED FUSELAGE STRUCTURES
Richard A. Ely *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 32 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The application of constrained layer damping, in the form of laminated skins, frames, and equipment racks, to control acoustic fatigue of structures and vibration of equipment in the aft fuselage sections of large aircraft is discussed. It is shown that the influence of constrained layer damping on the response of a honeycomb panel at its critical frequency is very different from the influences on its resonant responses. The discussed baseline data and background methodology include: laboratory characterization of materials, acoustical fatigue tests of baseline and laminated structures, peculiarities of structures with high damping, influences of various boundary conditions on damped panels, dynamic versus static stiffness of damped panels, and comparisons of predicted and measured stresses in damped and undamped panels that are representative of aircraft structures. Advanced metallic technology and constrained layer damping are utilized to redesign the A-7 center section leading edge flap and the F-111 outboard spoiler to achieve large increases in their acoustical fatigue lives. E.A.K.

N86-21917# Boeing Co., Seattle, Wash.
BEAM DAMPERS FOR SKIN VIBRATION AND NOISE REDUCTION IN THE 747
R. N. Miles *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 17 p ref (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A special constrained layer damper was incorporated into the Boeing 747 upper deck fuselage structure. The damper replaces a rivetted stiffener which was installed to reduce noise levels inside the cabin. It was found that the damper installation produced a noise reduction equal to that achieved by the stiffener and resulted in an $8000 per airplane cost savings and a 130 pound per airplane weight savings. The analysis and test that led to this design are reviewed. E.A.K.

N86-21918# Boeing Military Airplane Development, Seattle, Wash.
INTEGRATED DAMPED FUSELAGE STRUCTURE
L. M. Butzel *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 29 p (For primary document see N86-21883 12-39)
(Contract F33615-79-C-3206)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A program aimed at developing design guidelines for viscoelastic damping applied to skin-stringer-frame type aerospace structure is described. Periodic structure type response models were

developed. Two procedures for assigning values of the damping parameters required in these models are presented. Results of test to develop and verify the damping parameter assignment procedure and response prediction models are discussed. The current status of these efforts is: (1) response models are yielding predictions in agreement with test results; (2) the damping parameter assignment procedures are working, however, more work is needed to bring them up to the confidence level of the response models. E.A.K.

N86-21919# Cabot Corp., Indianapolis, Ind. E-A-R Div.
USE OF SKIN DAMPING TREATMENTS TO CONTROL AIRFRAME DYNAMIC RESPONSE FOR INTERIOR NOISE CONTROL
C. I. Holmer *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 19 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A conceptual model for airframe and interior trim dynamic response. The model suggests that skin response in the frequency range may be affected by skin damping treatments. It is suggested that this motion is of significance in producing interior noise. Laboratory data of system loss factors for a new constrained layer, skin damping treatment show improved damping performance at lighter weight than other commercially available skin damping materials. Experimental data on an effective skin damping treatment which produces system loss factors which contribute significantly to total losses in the airframe in the presence of other loss mechanisms associated with the outfitted airframe are presented. The effective skin damping treatment reduces airframe motion at representative trim panel attachment points, suggesting role in the reduction of aircraft interior noise. E.A.K.

N86-21920# Rockwell International Corp., Seal Beach, Calif.
DAMPING APPLICATION TO SPACECRAFT
T. S. Nishimoto *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 7 p (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Various cases of design application of damping technology to spacecraft development are presented. Various vibration problems for which damping was used as a design tool are illustrated. The examples of damping applications are a succession of spacecraft hardware design problems from the component level to the spacecraft system. Typical confining constraints which work to the detriment of the engineering effort are illustrated. Late fixes to equal vibration failure necessarily loads to less than desirable design solutions. The example of integrating damping into the preliminary design process for system solutions points to the technology requirements necessary. E.A.K.

N86-21921# Boeing Aerospace Co., Seattle, Wash.
APPLICATION OF DAMPING TO IMPROVE RELIABILITY OF IUS-TYPE SATELLITE EQUIPMENT: RELSAT PROGRAM
Roy Ikegami, Clark J. Beck, and William J. Walker *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 14 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The status of the RELiability of SATellite equipment in environmental vibration (RELSAT) Program is presented. The program objectives, approach, goals and schedule are discussed. The work performed is described the selection of the inertial upper stage (IUS) as the baseline system for development in the RELSAT program. Work performed is which contains typical passive damping design concepts under consideration, and component developmental testing and finite element modeling results. E.A.K.

N86-21922# General Electric Co., Philadelphia, Pa. Space Systems Div.
DAMPING IN SUPPORT STRUCTURES FOR SATELLITE EQUIPMENT RELIABILITY: RELSAT
J. A. Staley and C. V. Stahle *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 25 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The reliability for satellite equipment in environmental vibration (RELSAT) program is discussed. The need for and benefits from applying damping treatments to satellite equipment panels to reduce component vibration during launch and ground vibration tests are discussed. Application of the same technology would directly benefit efforts to provide very stable platforms to meet high pointing accuracy requirements of satellites. The technology used to develop damped panel designs is discussed and a cost reliability model used to assess the cost benefit of reduced vibration is described. The RELSAT program which demonstrates the technology for vibration reduction of damped satellite equipment panels is described. E.A.K.

N86-21923# Lockheed-California Co., Burbank.
A DESIGN GUIDE FOR DAMPING OF AEROSPACE STRUCTURES
J. Soovere, M. L. Drake (Dayton Univ., Ohio), and V. R. Miller (Air Force Wright Aeronautical Lab., Wright-Patterson AFB, Ohio) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 9 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The effectiveness of polymeric damping materials in controlling resonant vibration problems has been established through many successful applications. The area of these applications range from aircraft structures to jet engine structures. The development of a viscoelastic damping design guide for use by designers is outlined. A brief outline of this effort is presented. E.A.K.

N86-21924# Massachusetts Inst. of Tech., Cambridge.
DISTRIBUTED PIEZOELECTRIC-POLYMER ACTIVE VIBRATION CONTROL OF A CANTILEVER BEAM
Thomas Bailey and James E. Hubbard, Jr. *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 22 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

An active vibration damper for a cantilever beam was designed using a distributed-parameter actuator and distributed-parameter control theory. The distributed-parameter actuator was a piezoelectric polymer, poly(vinylidene fluoride). Lyapunov's second method for distributed-parameter systems was used to design a control algorithm for the damper. Preliminary testing of the damper was performed on the first mode of the cantilever beam. A linear, constant-gain controller and a nonlinear constant-amplitude controller were compared. The constant-gain controller provided more than a factor of 2 increase in the modal damping with a feedback voltage limit of 200 VRMS. With the same voltage limit, the constant-amplitue controller achieved the same damping as the constant-gain controller for large vibrations, but increased the damping by a factor of 40 to at least eat=0.040 for small vibration levels. E.A.K.

N86-21925# TRW, Inc., Redondo Beach, Calif. Engineering Mechanics Lab.
AN EXPERIMENTAL STUDY OF PASSIVE DAMPING AND ACTIVE CONTROL OF LARGE SPACE STRUCTURES
S. S. Simonian, C. S. Major, and R. Gluck *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 40 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

A methodology for incorporating passive dampers in large space systems (LSS) design is presented. The methodology focuses on modular, discrete viscoelastic dampers which are integrally designed into the structure. The application of the methodology to the LSS experiment, a laboratory demonstration of a structure supporting a simulated optical mirror and subject to active and passive vibration control is described. Performance evaluation of the damped structure design was obtained by the modal strain energy technique, based on finite element models in Program NASTRAN. A parameter variation study of the damper's performance was conducted, yielding, for the first three modes of a nominal damper configuration, an augmented modal damping

ratio of 9% of critical damping. This amount of passive damping, which is an order of magnitude larger than the residual damping present in the original structure, is obtained with a mere 8% penalty in structural weight. E.A.K.

N86-21926# Martin Marietta Aerospace, Denver, Colo. Guidance and Control Section.
SIZING OF DISCRETE VISCOUS DAMPERS ON A FLEXIBLE BODY IN THE PRESENCE OF A FIXED CONTROLLER
George R. Rapacki and Robert B. Rice *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 27 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The effects of discrete viscous dampers on a spacecraft's rigid body control loop were investigated. The damper's affect on the open loop gain and phase margins, the shape of the open loop gain-phase plot and the flexible body dynamics were determined as a function of the viscous damper's strength and the mass connected to the damper. The damper is sized for those configurations where the added damper improves the system robustness. E.A.K.

N86-21927# State Univ. of New York, Buffalo. Dept. of Mechanical and Aerospace Engineering.
CRITICAL DAMPING IN COMPLEX STRUCTURES AND CONTROL SYSTEMS
D. J. Inman *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 11 p refs (For primary document see N86-21883 12-39)
(Grant AF-AFOSR-0242-82)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The concept of critical damping normally defined for single degree of freedom systems as applied to more complex models of structures and their control systems was examined. Complex models refers to lumped mass models, such as finite element models (FEM), full distributed parameter (DPS) models (described by sets of partial differential equations), hybrid systems (systems with lumped and distributed parameter elements, such as passive control systems) and active control systems consisting of the models subject to position and velocity feedback. Critical damping of FEM and DPS models is reviewed and applied to more general linear models. E.A.K.

N86-21928# Martin Marietta Aerospace, Denver, Colo.
AN APPROACH TO THE SIZING OF DISCRETE VISCOUS STRUCTURAL DAMPERS USING AN EXTENSION OF THE FINITE ELEMENT APPROACH AND MODAL STRAIN ENERGY
Robert B. Rice and Eric C. Dalton (Teledyne Brown Engineering, Huntsville, Ala.) *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 20 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/Mf A01 CSCL 20/11

A method to determine viscous damper values and damper locations for a structure which has particular damping requirements is presented. The method is intended as a starting point in a design process. The finite element approach and concept of modal strain energy are relied upon. The method was applied to a large space-based telescope in which damping of optical support structures is critical for tracking and pointing accuracy. It is indicated that the method will yield the desired amount of damping a structure provided that the complex mode shapes do not significantly deviate from the classical shapes. The characterization of nonviscous dampers is considerably more complicated than viscous dampers, it is suggested that the method be used in the early phases of design. If viscous damping values are known, the range of other candidate dampers may be narrowed. E.A.K.

N86-21929# General Electric Co., Philadelphia, Pa. Control Systems Design.
FLEXIBLE STRUCTURE CONTROL IN THE FREQUENCY DOMAIN
R. Harding and A. Das *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 20 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

Techniques to analyze structure and controller interaction in the frequency domain are defined and used to determine the modal damping requirements of the spacecrat structure to assure control system stability and performance. Gain and phase versus frequency techniques are described which predict system stability in the presence of uncontrolled structural modes and errors in a priori natural frequencies and quantify control system margin for these modes. The techniques are applied to an optimally controlled single axis satellite with very large solar arrays. Control system actuator and sensor configurations are based upon system controllability and observability of four dominant structural modes. E.A.K.

N86-21930# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PASSIVELY DAMPED JOINTS FOR ADVANCED SPACE STRUCTURES
Richard W. Trudell, Lawrence W. Rehfield (Georgia Inst. of Tech., Atlanta), Ambur D. Reddy (Georgia Inst. of Tech., Atlanta), Jacky Prucz (Georgia Inst. of Tech., Atlanta), and James Peebles *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 28 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

The benefits to be gained by designing damping into the joints of large space structure are described. A typical joint is developed and two new nonresonant test techniques are outlined. The joints are double-lap shear joints that dissipate energy when worked in an axial direction. To better understand the relationship between structural stiffness and structural damping as a function of important physical parameters, a one-dimensional analysis of a typical joint was dveloped. Two new nonresonant forced vibration test methods (steady state and transient) were developed that are particularly well suited for obtaining the damping characteristics of joints in large space structures. The steady state method does not require measurement of relative displacements. The transient sine-pulse approach frees the specimen from fixture/joint interaction effects. E.A.K.

N86-21931# Martin Marietta Aerospace, Denver, Colo.
PASSIVE AND ACTIVE CONTROL OF SPACE STRUCTURES (PACOSS) Abstract Only
Charles White *In* AFWAL Vibration Damping 1984 Workshop Proceedings Nov. 1984 1 p (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

An early objective of the PACOSS program was to experimentally verify that substantial passive damping was practical in test articles generally representative of large space structure in arrangement, dimensional size, and frequency range. Two 60-foot, truss-type test articles were designed, fabricated, and tested. For one large generic test article (LGTA) in one plane, The diagonal members are Lexan;l in the other plane, the five lower bays have included discrete link dampers in the diagonals. The other LGTA has only Plexiglas diagonals in one plane, and also includes the five bays of link dampers in the other plane. E.A.K.

N86-21932*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
BURNER LINER THERMAL-STRUCTURAL LOAD MODELING
R. Maffeo [1986] 205 p
(Contract NAS3-23272)
(NASA-CR-174892; NAS 1.26:174892) Avail: NTIS HC A10/MF A01 CSCL 20K

The software package Transfer Analysis Code to Interface Thermal/Structural Problems (TRANCITS) was developed. The TRANCITS code is used to interface temperature data between thermal and structural analytical models. The use of this transfer module allows the heat transfer analyst to select the thermal mesh density and thermal analysis code best suited to solve the thermal problem and gives the same freedoms to the stress analyst, without the efficiency penalties associated with common meshes

and the accuracy penalties associated with the manual transfer of thermal data. E.A.K.

N86-21933*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FULL-SCALE TRANSPORT CONTROLLED IMPACT DEMONSTRATION
Robert J. Hayduk, comp. Jan. 1986 356 p refs Workshop held in Hampton, Va., 10 Apr. 1985; sponsored by NASA. Langley Research Center and FAA
(NASA-CP-2395; L-16048; NAS 1.55:2395) Avail: NTIS HC A16/MF A01 CSCL 20K

The controlled impact demonstration (CID) test of a transport aircraft took place on December 1, 1984, crashing at a prepared site on Rogers Dry Lakebed, Edwards Air Force Base, California. The demonstration was a setback for the antimisting kerosene (AMK) researchers. The impact conditions, considerably different from the planned scenario, exposed large quantities of degraded AMK and hydraulic fluid and caused unexpectedly hot ignition sources, bulk loss of fuel from the right wing, airflow patterns over the wings and fuselage that were untested on AMK, and fuel intrusion into the lower fuselage. The test was much more severe than planned and is generally considered to be unrepresentative of the type of survivable crash that would benefit from AMK. Ninety-seven percent of the sensors on the fuselage and wing structure, seats, dummies, restraint systems, galley, and bins were active at impact. A wealth of sensor data was collected from this once-in-a-lifetime research test. The flight data recorder experiments on board were also generally successful. For individual titles, see N86-21934 through N86-21949.

N86-21934*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CID OVERVIEW
Robert J. Hayduk *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 1-16 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

On December 1, 1984, NASA and the Federal Aviation Administration (FAA) conducted the first remotely piloted air-to-ground crash test of a transport category aircraft. The Full-Scale Transport Controlled Impact Demonstration (CID) was the culmination of 4 years of effort by the two agencies. NASA and the FAA had many objectives during the joint planning and execution of the Controlled Impact Demonstration. The structural loads experiment was very successful. Ninety-seven percent of the channels were active at impact. The data is still being assessed. Only a portion of the data is presented here; approximately 80 channels of data are available. Analysis of the remaining data is in progress. Interior photography was also very successful. One hundred percent of the cameras functioned. The film contains unique information on the development of fire and smoke in the interior of the aircraft. From a human tolerance point of view, the CID was simulation of a survivable crash. R.J.F.

N86-21935*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.
CID FLIGHT/IMPACT
Russ Barber *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 17-28 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

The planned versus the actual results of the controlled impact demonstration of a transport aircraft are discussed. Remote control systems, site selection, manned flight tests, and wreckage distribution are discussed. R.J.F.

N86-21936*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NASA EXPERIMENTS ON THE B-720 STRUCTURE AND SEATS **c35**
Emilio Alfaro-Bou *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 29-47 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

Two experiments onboard a remotely piloted transport aircraft that was crashed on landing are discussed. The structural experiment deals with the location and distribution of the instrumentation throughout the airplane structure. In the seat experiment, the development and testing of an energy absorbing seat are discussed. The objective of the structural experiment was to obtain a data base of structural crash loads for use in the advancement of crashworthy technology of materials (such as composites) in structural design and for use in the comparison between computer and experimental results. The objective of the seat experiment was to compare the performance of an energy absorbing transport seat and a standard seat when subjected to similar crash pulses. Details are given on the location of instrumentation, on the dynamic seat test pulse and headward acceleration limits. R.J.F.

N86-21937*# Federal Aviation Agency, Atlantic City, N.J. Technical Center.
CONTROLLED IMPACT DEMONSTRATION SEAT/CABIN RESTRAINT SYSTEMS: FAA
Richard A. Johnson *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 49-60 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

The FAA restraint system experiments consisted of 24 standard and modified seats, 2 standard galleys and 2 standard overhead compartments. Under the controlled impact demonstration (CID) program, the experimental objective was to demonstrate the effectiveness of individual restraint system designs when exposed to a survivable air-to-ground impact condition. What researchers were looking for was the performance exhibited by standard and modified designs, performance differences resulting from their installed cabin location, and interrelating performance demonstrated by test article and attaching floor and/or fuselage structure. The other restraint system experiment consisted of 2 standard overhead stowage compartments and 2 galley modules. Again, researchers were concerned with the retention of stowed equipment and carry-on articles. The overhead compartments were loaded with test weights up to their maximum capacity, and each of the galleys was filled with test articles: aft with normal galley equipment, forward with hazardous material test packages. A breakdown of instrumentation and distribution is given beginning with 11 instrumented type anthropomorphic dummies and 185 sensors which provided for acceleration and load measurements at the various experiment and associated structure locations. The onboard cameras provided additional coverage of these experiments, including the areas of cabin which were not instrumented. Test results showing the window-side leg forces versus pulse duration are given. R.J.F.

N86-21938*# Space Development Corp., Hampton, Va.
DATA REDUCTION, MANAGEMENT, AND ANALYSIS SOFTWARE FOR CID **c60**
Charles W. Davis *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 61-77 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

In an overview of the Data Reduction System, three major steps are examined. First, the raw data tapes were selected from the onboard recorders. These tapes should provide the best quality data for the data reduction software system. These tapes contained 352 channels of data, plus the monitor channels recorded in 8 bit Pulsed Coded Modulation (PCM) words. The next step consists of transcribing the PCM tapes from 8 bit serial digital data to 8 bit parallel digital data. This puts the data in the correct format for processing. The transcription process was accomplished here at LaRC in the Central Data Transportation Facility (CDTF). The last step in this 3 step process is to process the data through the reduction system developed for the Impact Dynamic Research Facility in the early part of 1980. Processing system criteria, system interface routines, and engineering units program that reads

digitized data from tapes, and file management programs are discussed. R.J.F.

N86-21939*# PRC Kentron, Inc., Hampton, Va.
NASA SEAT EXPERIMENT AND OCCUPANT RESPONSES
E. L. Fasanella *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 79-89 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

Results of the crash test of a remotely piloted transport aircraft instrumented to measure a NASA energy-absorbing transport seat are given. Human tolerance limits to acceleration and a dynamic response index model are discussed. It was found that the acceleration levels at the rear of the airplane were quite low and were below the stroking threshold of the NASA EA-seat. Therefore, dummies in the standard and EA-seat responded approximately the same. All longitudinal accelerations were quite low for the primary impact with very low forces measured in the lap belts. The vertical (spineward) acceleration levels measured in the dummies were also relatively low and very survivable from an impact tolerance standpoint. The pilot with an 18 G peak acceleration received by far the highest vertical acceleration and could have possibly received slight spinal injury. R.J.F.

N86-21940*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURAL LOADS PRELIMINARY RESULTS
Emilio Alfaro-Bou *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 91-102 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

From a total of 351 instrumentation channels, 341 channels (97%) were in operation during the initial impact of the airplane. Both NASA seats, the energy absorbing seat and the standard seat, maintained their integrity during the impact. The floor accelerations at the seat locations were lower than the accelerations required for the energy absorbers to stroke; consequently, the energy absorbing seat did not stroke. The two seats remained firm in place during the crash and no seat attachment failures were observed. Due to the low accelerations experienced during the crash, both seats performed as standard seats. In the airplane structure, the accelerations were higher at both the point of impact in the left wing and at the forward end of the fuselage. The accelerations on the floor were higher toward the front than toward the rear and the floor accelerations on the left side were higher than on the right side at the front of the fuselage, but toward the rear they evened out. Author

N86-21941*# PRC Kentron, Inc., Hampton, Va.
DIGITAL FILTERING AND ACCELERATION PULSE INTERPRETATION **c64**
E. L. Pasanella *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 103-123 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 12A

It was concluded that the post processing digital filter is quite effective for removing unwanted high frequency and noise without distorting the signal. In addition, digital filtering is effective for smoothing low-level low resolution digital data where the digital stairstep phenomena are pronounced. Integrating the acceleration data to obtain velocity traces is quite useful. The velocity change provides a check on the validity of the acceleration trace. (Zero offsets in acceleration must be removed before integrating.) Average accelerations can be obtained from the velocity trace by dividing the change in velocity for an acceleration pulse by the pulse duration. One can obtain the peak of an equivalent triangular pulse by doubling the average acceleration. Author

N86-21942*# Simula, Inc., Phoenix, Ariz.
PRELIMINARY FLOOR, SEAT, AND DUMMY DATA
Mark R. Cannon and Richard E. Zimmerman *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 125-155 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

According to preliminary examination of the data, out of 179 data channels that were onboard the aircraft in support of the seat experiments, there is data from 168. There was somewhat more severe environment imposed in the structure of the obstacles than by the ground impact. Therefore, both ground impact and obstacle impact are of interest for crashworthiness experiments. Most of the data channels that were studied are fairly consistent with the physical evidence: they show acceleration levels that are reasonable, and in many cases these integrate out to a reasonable velocity change. Finally, from observation thus far, the ground impact did not fail or significantly damage any seat. Nor did any of the energy absorbers in the modified seats extend. The accelerations do not appear high enough and/or energetic enough to cause this to happen. At this time, the onboard films have not been studied; only some videotape have been viewed. Some of the seats were so badly damaged by the fire that any failures which might have occurred were obscured. A close examination of the onboard films using a stop-action projector will allow a more thorough evaluation. Author

N86-21943*# Federal Aviation Administration, Long Beach, Calif.
CONTROLLED IMPACT DEMONSTRATION AIRFRAME BENDING BRIDGES
Stephen J. Soltis *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 157-179 (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

The calibration of the KRASH and DYCAST models for transport aircraft is discussed. The FAA uses computer analysis techniques to predict the response of controlled impact demonstration (CID) during impact. The moment bridges can provide a direct correlation between the predictive loads or moments that the models will predict and what was experienced during the actual impact. Another goal is to examine structural failure mechanisms and correlate with analytical predictions. The bending bridges did achieve their goals and objectives. The data traces do provide some insight with respect to airframe loads and structural response. They demonstrate quite clearly what's happening to the airframe. A direct quantification of metal airframe loads was measured by the moment bridges. The measured moments can be correlated with the KRASH and DYCAST computer models. The bending bridge data support airframe failure mechanisms analysis and provide residual airframe strength estimation. It did not appear as if any of the bending bridges on the airframe exceeded limit loads. (The observed airframe fracture was due to the fuselage encounter with the tomahawk which tore out the keel beam.) The airframe bridges can be used to estimate the impact conditions and those estimates are correlating with some of the other data measurements. Structural response, frequency and structural damping are readily measured by the moment bridges. R.J.F.

N86-21944*# Federal Aviation Agency, Atlantic City, N.J. Technical Center.
CONTROLLED IMPACT DEMONSTRATION FLIGHT DATA RECORDERS/COCKPIT VOICE RECORDERS
Leo J. Garodz *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 181-193 ref (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

It was found that the sampling rates from flight recorders on a remotely piloted transport aircraft that crashed into the ground were too low, although they were higher than those required now by regulations. For example, the sampling rate for roll angle was one per second. The sampling rate for normal acceleration was also fairly low. Existing regulations require only 4 samples per second; researchers had 16 samples per second. Some data was lost during the initial impact. The frequency response data was adequate. R.J.F.

N86-21945*# Naval Air Test Center, Patuxent River, Md.
UNITED STATES NAVY - CANADIAN FORCES SOLID STATE

FLIGHT DATA RECORDER/CRASH POSITION LOCATOR EXPERIMENT ON THE B-720 CONTROLLED IMPACT DEMONSTRATION

D. M. Watters *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 195-208 (For primary document see N86-21933 12-39)

Avail: NTIS HC A16/MF A01 CSCL 20K

The operation of a radio beacon position locator during and after the remotely controlled transport aircraft is discussed. The radio beacon transmission was actuated and was picked up by the Navy P-3A chase aircraft for a short time, after which reception was lost. The pilot reported that he received a signal on both 121.5 MHz and 243 MHz for a period of approximately 5 seconds. Five minutes after the crash a portable direction finding unit located on the roof of the NASA Dryden Flight Research Facility, 4 miles distant from the crash, was unable to pick up the beacon transmission. The fire crews started fighting the fires approximately 90 seconds after the time of impact. Navy personnel access to the crash site was allowed on the morning of December 2, 1984. Radio beacon locator was found resting top side up, 15 feet forward and 13 feet perpendicular from the tray location the starboard side of the aircraft. An immediate inspection indicated the airfoil suffered moderate fire damage with paint peeling but not intumescing. The visual marker strobe lamp housings were intact but extensively burned such that it was impossible to see if the lamps had survived. The airfoil suffered minor structural damage, with assorted dents, etc. The extended plunger on the ARU-21 release unit indicated that the pyrotechnic deployment system operated. The radio beacon base (tray) suffered some heat and fire damage, and was charred and blackened by smoke. The frangible switch in the nose survived and the switch in the belly was recovered and found to have actuated. It is assumed that this switch fired the ARU-21 squib. There were no other release switches installed in the normally open system in the aircraft. R.J.F.

N86-21946*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CONTROLLED IMPACT DEMONSTRATION ON-BOARD (INTERIOR) PHOTOGRAPHIC SYSTEM

Clyde J. May *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 209-239 ref (For primary document see N86-21933 12-39)

Avail: NTIS HC A03/MF A01 CSCL 20K

Langley Research Center (LaRC) was responsible for the design, manufacture, and integration of all hardware required for the photographic system used to film the interior of the controlled impact demonstration (CID) B-720 aircraft during actual crash conditions. Four independent power supplies were constructed to operate the ten high-speed 16 mm cameras and twenty-four floodlights. An up-link command system, furnished by Ames Dryden Flight Research Facility (ADFRF), was necessary to activate the power supplies and start the cameras. These events were accomplished by initiation of relays located on each of the photo power pallets. The photographic system performed beyond expectations. All four power distribution pallets with their 20 year old Minuteman batteries performed flawlessly. All 24 lamps worked. All ten on-board high speed (400 fps) 16 mm cameras containing good resolution film data were recovered. R.J.F.

N86-21947*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CID-720 AIRCRAFT HIGH-ENVIRONMENT FLIGHT INSTRUMENTATION SYSTEM

R. S. Calloway *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 241-287 (For primary document see N86-21933 12-39)

Avail: NTIS HC A16/MF A01 CSCL 20K

The high-environment flight instrumentation system was designed to acquire Langley's structural response data during the full scale transport-controlled impact demonstration test. There was only one opportunity for data acquisition. Thus, a high reliability and crashworthy design approach was implemented. The approach featured multi-level redundancy and a vigorous quality assurance testing program. Complying with an accelerated schedule, the instrumentation system was developed, tested and shipped within 18 months to Dryden Flight Research Facility. The flight instrumentation system consists of two autonomous data systems, DAS #1 and #2, and an excellent checkout subsystem. Each data system is partitioned into four pallets. The system was designed to operate on manned and unmanned flights. There are 176 data channels per data system. These channels are sequentially sampled and encoded into 1 megabit/sec pulse code modulation (PCM) data signal. To increase the probability of success, a special PCM distribution subsystem was developed. This subsystem distributes the PCM signal to two transmitters, one delay memory, and eight recorder tracks. The data on four of these trackes was digitally delayed approximately 300 msec to maximize data acquisition during impact. Therefore each data system's data is redundantly recorded onboard and on the ground. There are two time code generators. Parallel time from each is encoded into both data systems. Serial time from each is redundantly recorded on both onboard recorders. Instrumentation power is independent of aircraft power and self-contained. R.J.F.

N86-21948*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

IMPACT DYNAMICS INSTRUMENTATION **c35**

Royce F. McCormck *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 289-301 (For primary document see N86-21933 12-39)

Avail: NTIS HC A16/MF A01 CSCL 20K

One of the tasks specified in the NASA Langley controlled impact demonstration (CID) work package was to furnish dynamic instrumentation sensors. The types of instrumentation sensors required were accelerometers for aircraft structural loads measurements, seat belt load cells to measure anthropomorphic dummy responses to the aircraft impact, and strain gage bending bridges to measure the aircraft fuselage and wing bending during impact. The objective in the selection of dynamic instrumentation for the CID was to provide 352 of the highest quality transducers and remain within budget allocation. The transducers that were selected for the CID evaluation process were each subjected to rigorous laboratory acceptance tests and to aircraft fuselage section drop tests at the LaRC Impact Dynamics Research Facility. Data compiled from this series of tests showed the selected transducers to be best suited for the CID mission requirement. The transducers installation technique on the airframe proved successful. The transducer quality assurance was guaranteed through rigorous acceptance testing. Data acquired was 97.0%. R.J.F.

N86-21949*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CID-720 AIRCRAFT LANGLEY RESEARCH CENTER PREFLIGHT HARDWARE TESTS: DEVELOPMENT, FLIGHT ACCEPTANCE AND QUALIFICATION

J. D. Pride *In its* Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 303-328 ref (For primary document see N86-21933 12-39)

Avail: NTIS HC A16/MF A01 CSCL 20K

The testing conducted on LaRC-developed hardware for the controlled impact demonstration transport aircraft is discussed. To properly develop flight qualified crash systems, two environments were considered: the aircraft flight environment with the focus on vibration and temperature effects, and the crash environment with the long pulse shock effects. Also with the large quantity of fuel in the wing tanks the possibility of fire was considered to be a threat to data retrieval and thus fire tests were included in the development test process. The aircraft test successfully demonstrated the performance of the LaRC developed heat shields. Good telemetered data (S-band) was received during the impact and slide-out phase, and even after the aircraft came to rest. The two onboard DAS tape recorders were protected from the intense fire and high quality tape data was recovered. The complete photographic system performed as planned throughout the 40.0 sec of film supply. The four photo power distribution pallets remained in

good condition and all ten onboard 16 mm high speed (400 frames/sec) cameras produced good film data. R.J.F.

N86-21950*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A TORQUE, TENSION AND STRESS CORROSION EVALUATION OF HIGH STRENGTH A286 BOLTS
J. W. Montano Feb. 1986 27 p
(NASA-TM-86539; NAS 1.15:86539) Avail: NTIS HC A03/MF A01 CSCL 20K

The problems associated with overtorque applied to the Booster Separation Motor (BSM) Igniter Adapter high strength [200 KSI (1379 Mpa)] A286 CRES bolts and the threaded holes of the 7075-T73 aluminum alloy BSM cases are addressed. The evaluation included torque, tensile, and stress corrosion tests incorporating the A286 CRES bolts and the 7075-T73 aluminum alloy BSM cases. The tensile test data includes ultimate tensile load (UTL), Johnson's 2/3 yield load (J2/3YL), proportional limit load (PLL), and total bolt stretch. Torque tension data includes torque, torque induced load, and positive and negative break-away torque. Stress corrosion test data reflect the overtorque and the resulting torque induced loads sustained by the A286 CRES bolts torqued into a 7075-T73 aluminum alloy forged dome with threaded holes. After 60 days of salt fog exposure, the positive and the negative break-away torques, the subsequent mechanical property tensile test results, and the BSM dome threaded hole axial tensile pullout loads are reported. Author

N86-21951*# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
FATIGUE CRACK GROWTH UNDER GENERAL-YIELDING CYCLIC-LOADING
Zheng Minzhong and H. W. Liu Feb. 1986 28 p refs
(Grant NAG3-348)
(NASA-CR-175049; NAS 1.26:175049) Avail: NTIS HC A03/MF A01 CSCL 20K

In low cycle fatigue, cracks are initiated and propagated under general yielding cyclic loading. For general yielding cyclic loading, Dowling and Begley have shown that fatigue crack growth rate correlates well with the measured delta J. The correlation of da/dN with delta J was also studied by a number of other investigators. However, none of thse studies have correlated da/dN with delta J calculated specifically for the test specimens. Solomon measured fatigue crack growth in specimens in general yielding cyclic loading. The crack tips fields for Solomon's specimens are calculated using the finite element method and the J values of Solomon's tests are evaluated. The measured crack growth rate in Solomon's specimens correlates very well with the calculated delta J. Author

N86-21952*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Engineering Mechanics.
ANISOTROPIC CONSTITUTIVE MODEL FOR NICKEL BASE SINGLE CRYSTAL ALLOYS: DEVELOPMENT AND FINITE ELEMENT IMPLEMENTATION Final Report
L. T. Dame and D. C. Stouffer Mar. 1986 130 p refs
(Grant NAG3-511)
(NASA-CR-175015; NAS 1.26:175015) Avail: NTIS HC A07/MF A01 CSCL 20K

A tool for the mechanical analysis of nickel base single crystal superalloys, specifically Rene N4, used in gas turbine engine components is developed. This is achieved by a rate dependent anisotropic constitutive model implemented in a nonlinear three dimensional finite element code. The constitutive model is developed from metallurigical concepts utilizing a crystallographic approach. A non Schmid's law formulation is used to model the tension/compression asymmetry and orientation dependence in octahedral slip. Schmid's law is a good approximation to the inelastic response of the material in cube slip. The constitutive equations model the tensile behavior, creep response, and strain rate sensitivity of these alloys. Methods for deriving the material constants from standard tests are presented. The finite element implementation utilizes an initial strain method and twenty noded isoparametric solid elements. The ability to model piecewise linear load histories is included in the finite element code. The constitutive equations are accurately and economically integrated using a second order Adams-Moulton predictor-corrector method with a dynamic time incrementing procedure. Computed results from the finite element code are compared with experimental data for tensile, creep and cyclic tests at 760 deg C. The strain rate sensitivity and stress relaxation capabilities of the model are evaluated. Author

N86-21953*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE LATDYN USER'S MANUAL
Jerrold M. Housner, Paul E. McGowan, A. Louis Abrahamson, and Michael G. Powell Jan. 1986 212 p refs
(NASA-TM-87635; NAS 1.15:87635) Avail: NTIS HC A10/MF A01 CSCL 20K

The LATDYN User's Manual presents the capabilities and instructions for the LATDYN (Large Angle Transient DYNamics) computer program. The LATDYN program is a tool for analyzing the controlled or uncontrolled dynamic transient behavior of interconnected deformable multi-body systems which can undergo large angular motions of each body relative other bodies. The program accommodates large structural deformation as well as large rigid body rotations and is applicable, but not limited to, the following areas: (1) development of large flexible space structures; (2) slewing of large space structure components; (3) mechanisms with rigid or elastic components; and (4) robotic manipulations of beam members. Presently the program is limited to two dimensional problems, but in many cases, three dimensional problems can be exactly or approximately reduced to two dimensions. The program uses convected finite elements to affect the large angular motions involved in the analysis. General geometry is permitted. Detailed user input and output specifications are provided and discussed with example runstreams. To date, LATDYN has been configured for CDC/NOS and DEC VAX/VMS machines. All coding is in ANSII-77 FORTRAN. Detailed instructions regarding interfaces with particular computer operating systems and file structures are provided. Author

N86-21954*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EQUIVALENT PLATE ANALYSIS OF AIRCRAFT WING BOX STRUCTURES WITH GENERAL PLANFORM GEOMETRY
Gary L. Giles Mar. 1986 12 p refs Proposed for presentation at the 27th AIAA/ASME/ASCE/ANS Structures, Structural Dynamics and Materials Conference, San Antonio, Tex., 19-21 May 1986
(NASA-TM-87697; NAS 1.15:87697; AIAA-86-0940-CP) Avail: NTIS HC A02/MF A01 CSCL 20K

A new equilvalent plate analysis formulation is described which is capable of modeling aircraft wing structures with a general planform such as cranked wing boxes. Multiple trapezoidal segments are used to represent such planforms. A Ritz solution technique is used in conjunction with global displacement functions which encompass all the segments. This Ritz solution procedure is implemented efficiently into a computer program so that it can be used by rigorous optimization algorithms for application in early preliminary design. A direct method to interface this structural analysis procedure with aerodynamic programs for use in aeroelastic calculations is described. This equivalent plate analysis procedure is used to calculate the static deflections and stresses and vibration frequencies and modes of an example wing configuration. The numerical results are compared with results from a finite element model of the same configuration to illustrate typical levels of accuracy and computation times resulting from use of this procedure. Author

N86-21955# North Carolina State Univ., Raleigh. Raleigh School of Engineering.
KINETICS AND MECHANISMS OF CREEP IN SINTERED ALPHA SILICON CARBIDE AND NIOBIUM CARBIDE Final Report, 1 May 1982 - 15 Jun. 1985

Robert F. Davis 18 Sep. 1985 60 p
(Grants NSF DMR-81-20804; ARO-MIPR-43-48)
(AD-A161455; ARO-18434.8-MS) Avail: NTIS HC A04/MF A01 CSCL 20/11

Constant stress compressive creep studies and complementary TEM research have been conducted on sintered alpha-SiC and on dense polycrystalline NbCO737 to determine the kinetics and the mechanisms of deformation as a function of temperature and stress. In the former material, the values of the stress exponents of 1.44 to 1.71 indicate that either viscous flow or grain boundary sliding is controlling creep. However, the values of the activation energies (approx. 400 kJ/mol below 1920 K and approx. 850 kJ/mol above 1920K) coupled with the TEM studies which show the presence of considerable dislocation glide activity and the formation of corrugated grain boundaries and the formation of porosity on the boundaries and voids at the triple points. GRA

N86-21956# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF THE DUCTILE TO BRITTLE TRANSITION TEMPERATURE OF PLATINUM-ALUMINIDE GAS TURBINE BLADE COATINGS M.S. Thesis
David J. Vogel Sep. 1985 63 p
(AD-A161518) Avail: NTIS HC A04/MF A01 CSCL 11/6

A strain-to-failure method was employed with Naval Postgraduate School tensile testing equipment to determine the ductile to brittle transition temperature (DBTT) of five basic platinum-aluminide gas turbine blade coatings on a nickel-base superalloy (IN738). THe results of these tests were compared to similarly formed nickel-aluminide coatings without platinum and aluminum content and structure on coating ductility. GRA

N86-21957# Texas Inst. for Computational Mechanics, Austin.
A FINITE ELEMENT ANALYSIS OF A CLASS OF PROBLEMS IN ELASTO-PLASTICITY WITH HIDDEN VARIABLES Final Report, 1 Feb. 1983 - 1 Oct. 1985
J. T. Oden Sep. 1985 161 p
(Contract DAAG29-83-K-0036)
(AD-A161642; TICOM-85-11; ARO-19499.4-MA) Avail: NTIS HC A08/MF A01 CSCL 12/1

A general theory of finite elastoplasticity deformations is developed which makes use of the generalized Clarke-Rockafellar subdifferentials from non-convex optimization theory and the notion of internal state variables. The theory involves two fundamental potential functionals, the free energy and a general flow potential. An exact kinematical description of large elastic-plastic deformations is given, together with a complete thermodynamics. New finite element methods are derived and several example problems are solved to illustrate the generality and utility of the theory and the numerical schemes. GRA

N86-21958# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
ELASTIC-PLASTIC LOADING AND UNLOADING IN A THICK TUBE WITH KINEMATIC HARDENING THEORY Final Technical Report
Peter C. T. Chen Sep. 1985 23 p Presented at the 3rd Army Conference, Applied Mathematics and Computing, Atlanta, Ga., 13-16 May 1985
(AD-A161733; AD-E440302; ARLCB-TR-85032) Avail: NTIS HC A02/MF A01 CSCL 20/11

Using Tresca's yield criterion, its associated flow rule, and the linear hardening law, analytical solutions have been obtained for elastic-plastic loading and unloading problems in a thick tube subjected to uniform internal pressure. Explicit expressions for the displacement, strains, and stresses are presented herein, along with numerical results for a closed-end tube. GRA

N86-21959# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
THERMO-MECHANICAL AND THERMAL BEHAVIOR OF HIGH-TEMPERATURE STRUCTURAL MATERIALS Final Summary Report, 1 Apr. 1978 - 31 Dec. 1984
D. P. H. Hasselman, M. M. Abraham, G. R. Angell, S. Baskaran, and E. K. Beauchamp 31 Dec. 1984 13 p
(Contract N00014-78-C-0431)
(AD-A161741) Avail: NTIS HC A02/MF A01 CSCL 20/13

A seven-year study was conducted of the thermo-mechanical and thermal behavior of high-temperature structural materials, described in detail in earlier technical interim and end-of-the-fiscal-year letter reports, listed in this bibliography. This reseach project resulted in a total of 85 technical publications in the engineering and scientific literature involving a total of fifty-three different co-authors. Author (GRA)

N86-21960# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
ON THE ROLES OF CORROSION PRODUCTS IN LOCAL CELL PROCESSES Annual Technical Report
H. W. Pickering Jan. 1986 70 p
(Contract N00014-84-K-0201)
(AD-A162448) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper reviews work performed on the roles that corrosion products play in corrosion and materials degradation processes. Subject areas include: (1) wedging action in which the tensile stresses required for crack propagation are generated by the formation of solid corrosion products within the crack cavity; (2) gas bubble formation and coalescence that eventually fills a major volume segment of a pit, crevice or crack; (3) an experimental determination and mathematical modeling of the local electrode potential and solution composition existing within active pits and crevices; (4) an analysis that shows the existence of a limiting electrode potential, E sub LIM, in a cavity and defines its value; (5) an analysis based on the E sub LIM concept and on known trends in concentrations of ionic species that provides a means for distinguishing between stress corrosion and hydrogen cracking in noble metal alloys. GRA

N86-21961# Failure Analysis Associates, Palo Alto, Calif.
FRACTURE CONTROL FOR FIXED OFFSHORE STRUCTURES Final Report, Apr. 1982 - Jul. 1983
P. M. Besuner, K. Ortiz, J. M. Thomas, and S. D. Adams Dec. 1984 213 p
(AD-A162507; FAA-83-6-2; SSC-328) Avail: NTIS HC A10/MF A01 CSCL 13/13

Literature and telephone surveys were conducted to determine the current status of fracture control as practiced by U.S. designers, builders, and operators. From this, recommendations are made for strengthening industry practices: promising areas for research are identified and prioritized, as are areas where cost-effective improvements could be made within existing technology. A fracture control checklist is also provided as an example of an unstructured, yet responsive, fracture control plan. It appears that there are two basic types of fracture problems. One type occurs because of poor workmanship or direct human error. Examples of this are significant crack initiations due to poor welding technique, construction overloads, and falling objects. Fracture control is achieved in these cases by preventing the errors from occurring. GRA

N86-21962# Pratt and Whitney Aircraft, West Palm Beach, Fla. Engineering Div.
THERMAL MECHANICAL FATIGUE CRACK GROWTH. AN APPLICATION FOR FRACTURE MECHANICS ANALYSES OF GAS TURBINE ENGINE DISKS Interim Report, Mar. 1981 - Jun. 1983
Dale A. Wilson and John R. Warren Mar. 1985 32 p
(Contract F33615-80-C-5160)
(AD-A162634; PW/ED/FR-18538; AFWAL-TR-84-4185) Avail: NTIS HC A03/MF A01 CSCL 20/11

The capability of the existing Hyperbolic Sine Model to accurately or conservatively predict the crack growth in engine components subject to thermal mechanical fatigue (TMF) was investigated. It was determined that existing empirical crack growth models adequately predict TMF crack growth under conditions tested, which reflect the current gas turbine engine retirement for cause requirements/applications. GRA

N86-21963# Rockwell International Science Center, Thousand Oaks, Calif.
INVESTIGATION INTO THE FATIGUE CRACK INITIATION PROCESS IN METALS Final Technical Report, 3 Sep. 1983 - 2 Sep. 1985
Fred W. L. Morris, Brian N. Cox, and Mike R. James Dec. 1985 85 p
(Contract N62269-83-C-0267)
(AD-A162663; SC5379.9FTD) Avail: NTIS HC A05/MF A01 CSCL 20/11

The foundation for a physically derived model of fatigue crack initiation in metals under spectrum loading is described. the work focuses on the microplastic deformation properties of a surface subject to stresses under the bulk elastic limit. A theoretical description of the highly localized plastic strains in individual surface grains, known to be pertinent to aluminum alloys, is developed with the support of high spacial resolution, high sensitivity strain measurements. These are made within individual grains of a Al 2219-T851 model material by a scanning electron microscopy technique. An important finding is that fatigue causes the local flow stresses in individual large surface grains to fall dramatically to less than 50% of their prefatigue values. the local stress-strain behavior is then controlled by the external load spectra, but is greatly influenced by the reaction stresses within a microplastic grain generated when its plasticity is constrained by the essentially elastic surface. Because of the constraint, the local stresses in a grain differ markedly from the applied. The theoretical models developed allow these stresses to be calculated and local mechanical properties of the surface including flow stress and plastic moduli to be estimated from experimental data. An especially interesting anti-clockwise motion of the external stress-local strain hysteresis loop near grain boundaries is observed, and is explained by a simple dual-domain deformation model. It results from an inhomogeneity in mechanical properties with a higher flow stress within the grain near the boundary. Opportunities for the use of such deformation theories to predict crack initiation lifetime are discussed. GRA

N86-21964# Naval Postgraduate School, Monterey, Calif.
GEOMETRICALLY NONLINEAR ANALYSIS OF SHELL STRUCTURES USING FLAT DKT SHELL ELEMENTS Progress Report, 1 Oct. 1984 - 30 Sep. 1985
Jean-Louis Batoz and Gilles Cantin 22 Nov. 1985 68 p
(AD-A162729; NPS69-85-007PR) Avail: NTIS HC A04/MF A01 CSCL 20/11

This report describes nonlinear analysis of arbitrary thin shell structures subjected to static loads. The nonlinear analysis includes pre and post-buckling behavior for any degree of nonlinearity due to large displacements and large rotations but small strains. The formulation includes some recent developments of plate and shell theories, automatic solution strategies for the nonlinear equations; all adapted for implementation in mini and micro-computers with virtual memory. GRA

N86-21965# Dayton Univ., Ohio. Research Inst.
OVERLOAD EFFECTS IN SUSTAINED LOAD CRACK GROWTH IN INCONEL 718 Interim Report, Jan. - Oct. 1985
T. Weerasooriya and T. Nicholas Nov. 1985 32 p
(Contract F33615-84-C-5051)
(AD-A162739; AFWAL-TR-85-4121) Avail: NTIS HC A03/MF A01 CSCL 20/11

Crack-growth-rate experiments were conducterd on CT specimens of Inconel 718 at 649 C. The loading spectrum consisted of a single 1 Hz cycle at R = 0.1 and a hold time. The ratio of the amplitude of the hold time to the maximum amplitude of the fatigue cycle, R sub in, was 1.0, 0.9, 0.8 and 0.5 with hold times from 0 to 200 s. Tests were performed under computer controlled constant K conditions using values of the maximum of the fatigue cycle of 40 and 50 MPa. the square root of m. Data show that for R sub in = 1.0, a linear summation model works well, while at R sub in = 0.9 there is a measurable retardation effect on the crack growth during the hold time. For values of R sub in less than 0.8, the sustained load crack growth is almost completely retarded. A simple retardation model is proposed which can fit the experimental data and is based on the concept of an overload plastic zone being produced by the fatigue cycles. It is concluded that hold times do not contribute to crack growth in this material unless their amplitude is at or near the maximum amplitude of the adjacent fatigue cycles. Author (GRA)

N86-21966# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
AIRBLAST LOADING OF WALL PANELS
Rickard Forsen Oct. 1985 24 p refs
(FOA-C-20586-D6; ISSN-0347-3694) Avail: NTIS HC A02/MF A01

Wall panels used in houses, including walls of reinforced concrete, brick mansonry, light weight concrete, and sandwich constructions, were laterally loaded with static and dynamic pressure. One way action elements in a full storey high test bench were used. Pressure load, deflection, and mode of deflection were recorded. Comparison of the test results for deflection with results from a single degree of freedom analysis indicates an increase of resistance at high velocities of deflection. Dynamic increase factors for the static resistance function were evaluated and used in calculations of isodamage curves for the walls tested. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-21967 Stanford Univ., Calif.
SPATIAL CLASSIFICATION OF URBAN LANDSCAPES FROM LANDCOVCER PROBAABILITIES DERIVED THROUGH REMOTE SENSING Ph.D. Thesis
Edward C. Driscoll, Jr. 1985 172 p
Avail: Univ. Microfilms Order No. DA8522134

A technique for classification of urban landuses from remotely sensed data such as aerial photographs is presented. Simulating the behavior of a human airphoto interpreter, it uses a two-stage approach, recognizing first landcover and then landuse. In the first stage, a straightforward multispectral classification technique is used to generate probability maps for a set of urban landcovers, e.g., grass, trees, asphalt, concrete, and shadow. Then the spatial nature of these landcover probabilities is examined and landuses are predicted based on neighborhood landcover mix and structure. Varying neighborhood sizes are explored. The algorithm is tested on a large urban dataset of Palo Alto, California, obtained by scanning a high altitude, infrared, aerial photograph to an effective resolution of 1.5 meters. Dissert. Abstr.

N86-21968*# Southern Methodist Univ., Dallas, Tex. Dept. of Geological Sciences.
CONSTRAINTS ON LITHOSPHERIC STRUCTURE FROM SATELLITE POTENTIAL FIELD DATA: AFRICA AND ASIA. ANALYSIS AND INTERPRETATION OF MAGSAT ANOMALIES OVER NORTH AFRICA Final Technical Report, 1 Mar. 1983 - 31 May 1985
Roger J. Phillips [1986] 104 p refs
(Grant NAG5-298)
(NASA-CR-176611; NAS 1.26:176611) Avail: NTIS

HC A06/MF A01 CSCL 08G

Crustal anomaly detection with MAGSAT data is frustrated by the inherent resolving power of the data and by contamination from the external and core fields. The quality of the data might be tested by modeling specific tectonic features which produce anomalies that fall within the proposed resolution and crustal amplitude capabilities of the MAGSAT fields. To test this hypothesis, the north African hotspots associated with Ahaggar, Tibestia and Darfur have been modeled as magnetic induction anomalies due solely to shallower depth to the Curie isotherm surface beneath these features. The MAGSAT data were reduced by subtracting the external and core fields to isolate the scalar and vertical component crustal signals. The predicted model magnetic signal arising from the surface topography of the uplift and the Curie isotherm surface was calculated at MAGSAT altitudes by the Fourier transform technique modified to allow for variable magnetization. In summary it is suggested that the region beneath Ahaggar is associated with a strong thermal anomaly and the predicted anomaly best fits the associated MAGSAT anomaly if the African plate is moving in a northeasterly direction. Author

N86-21969*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

COMPARISON OF MANUALLY PRODUCED AND AUTOMATED CROSS COUNTRY MOVEMENT MAPS USING DIGITAL IMAGE PROCESSING TECHNIQUES

Lisa K. Wynn 15 Dec. 1985 111 p refs

(Contract NAS7-100)

(NASA-CR-176653; JPL-PUB-85-90; NAS 1.26:176653) Avail: NTIS HC A06/MF A01 CSCL 05B

The Image-Based Information System (IBIS) was used to automate the cross country movement (CCM) mapping model developed by the Defense Mapping Agency (DMA). Existing terrain factor overlays and a CCM map, produced by DMA for the Fort Lewis, Washington area, were digitized and reformatted into geometrically registered images. Terrain factor data from Slope, Soils, and Vegetation overlays were entered into IBIS, and were then combined utilizing IBIS-programmed equations to implement the DMA CCM model. The resulting IBIS-generated CCM map was then compared with the digitized manually produced map to test similarity. The numbers of pixels comprising each CCM region were compared between the two map images, and percent agreement between each two regional counts was computed. The mean percent agreement equalled 86.21%, with an areally weighted standard deviation of 11.11%. Calculation of Pearson's correlation coefficient yielded +9.997. In some cases, the IBIS-calculated map code differed from the DMA codes: analysis revealed that IBIS had calculated the codes correctly. These highly positive results demonstrate the power and accuracy of IBIS in automating models which synthesize a variety of thematic geographic data. Author

N86-21970*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PERFORMANCE EVALUATION AND GEOLOGIC UTILITY OF LANDSAT-4 THEMATIC MAPPER DATA

Earnest D. Paylor, Michael J. Abrams, James E. Conel, Anne B. Kahle, and Harold R. Lang 15 Oct. 1985 77 p refs

(Contract NAS7-918)

(NASA-CR-176660; JPL-PUB-85-66; NAS 1.26:176660) Avail: NTIS HC A05/MF A01 CSCL 08B

The overall objective of the project was to evaluate LANDSAT-4 Thematic Mapper (TM) data in the context of geologic applications. This involved a quantitative assessment of the data quality including the spatial and spectral characteristics realized by the instrument. Three test sites were selected for the study: (1) Silver Bell, Arizona; (2) Death Valley, California; and (3) Wind River/Bighorn Basin area, Wyoming. Conclusions include: (1) Artificial and natural targets can be used to atmospherically calibrate TM data and investigate scanner radiometry, atmospheric parameters, and construction of atmospheric Modulation Transfer Functions (MTF's), (2) No significant radiometric degradation occurs in TM data as a result of SCROUNGE processing; however, the data exhibit narrow digital number (DN) distributiosn suggesting that the configuration of the instrument is not optimal for each science applications, (30 Increased spatial resolution, 1:24,000 enlargement capability, and good geometric fidelity of TM data allow accurate photogeologic/geomorphic mapping, including relative age dating of alluvial fans, measurement of structural and bedding attitudes, and construction of such things as structural cross sections and stratigraphic columns. (4) TM bands 5 and 7 are particularly useful for geologic applications because they span a region of the spectrum not previously sampled by multispectral scanner data and are important for characterizing clay and carbonate materials. Author

N86-21971# Geological Survey, Flagstaff, Ariz.

DESERT STUDIES: A GLOBAL VIEW Final Report, 5 Apr. 1982 - 30 Jun. 1985

John F. McCauley, Carol S. Breed, and Maurice J. Grolier 23 Aug. 1985 24 p

(Contract MIPR-155-84)

(AD-A161453; ARO-18405.12-GS) Avail: NTIS HC A02/MF A01 CSCL 08/6

Results of work on summary reports of the surficial geology and geomorphology of Coastal Peru, Western Desert of Egypt/Sudan, and deserts of China (including the Taklimakan, Badan Jarain, and Hohsi Corridor) are outlined. Sections of summary reports on these hyperarid regions have been published as journal articles, interim technical reports, and abstracts. Significant new findings have been described in interim published reports on the Western Desert. These include the discovery of a buried paleofluvial terrain, over printed by aeolian erosion and deposition, which controls the topography and trafficability of much of southwest Egypt and northwest Sudan. A new model for the Western Desert relates a series of superposed river networks, concealed beneath a centimeters-to-meters thick veneer of wind blown sand sheets and dunes to the composition and distribution of surficial and subjacent geologic units, including soil parent materials. A key finding has been the role of groundwater carbonate deposition in recording the sequence of Quarternary fluvial episodes and climatic fluctuations in this region, as well as the present-day influence of the caliche deposits on radar responses of interfluve, valley fill, and inset channel units. Preliminary results of field reconnaissance, LANDSAT, and Shuttle Imaging Radar (SIR-A and SIR-B) studies of deserts in Northwest China show evidence there, too, of radar signal penetration through dry sand to underlying bedrock and alluvium. GRA

N86-21972# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Fernerkundung.

INVESTIGATION OF THE INFORMATION CONTENT OF LANDSAT THEMATIC MAPPER (TM) AND SPOT MULTIBAND IMAGE DATA USING SIMULATED IMAGE DATA OF THE FREIBURG REGION

Werner Kirchhof, Wolfram Mauser (Freiburg Univ., West Germany), and Hans-Juergen Stiebig (Freiburg Univ., West Germany) Jun. 1985 146 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-975) Original contains color illustrations

(DFVLR-FB-85-49; ISSN-0171-1342) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 52

A comparative analysis of information content was performed using data sets with pixel sizes of 10, 20, 30, 50, and 80 m from LANDSAT TM simulation. The discrimination of objects, structures, and texture, depending on pixel size and combination of spectral bands, was investigated by visual interpretation and supervised classification for applications in agriculture and forestry. The new TM bands produce significant improvements in the separation of vegetated and built-up areas as well as in the delineation of the status of growth and humidity in comparison with LANDSAT MSS. The thematic mapper is eminently suited for the extraction of thematic information of surface areas of 1 hectare or more. Three to four spectral bands are normally sufficient. The information content of 20 m SPOT multiband data does not differ essentially

from that of comparable TM bands (TM2, TM3, TM4). A substantial complement to the TM information are structure and texture elements of the panchromatic 10 m SPOT band. Author (ESA)

N86-21973# Auburn Univ., Ala. Water Resources Research Inst.
[RESEARCH PROJECTS OF THE WATER RESOURCES RESEARCH INSTITUTE DURING FY 1983] Final Report
J. C. Warman and D. H. Block 1 May 1985 15 p
(Contract DI-14-08-0001-G-880)
(PB86-101235; USGS/G-880-01) Avail: NTIS HC A02/MF A01 CSCL 08H

Alabama's Water Resources Research Institute began expenditure of FY 1983 funds under Grant No. 14-08-0001-G880 about June 1, 1983, supporting six research projects. One project performed a sensitivity analysis of a biological toxicity model of an activated sludge process. The analysis indicated that the single most important factor in determining model output (based on the effluent organics concentration) is the retention time in the reactor and the second most important factor is the floc radius. Other projects addressed biodegradation of potential ground water pollutants by microorganisms in subsurface soil horizons; optimization of irrigation techniques to reduce water needs for fields with irregular boundaries. GRA

N86-21974# Colorado State Univ., Fort Collins.
COLORADO WATER RESOURCES RESEARCH INSTITUTE ACTIVITIES REPORT, FY 1981-1984 Final Report
Jun. 1985 26 p
(Contract DI-14-08-0001-G-895)
(PB86-101367; USGS/G-895-01) Avail: NTIS HC A03/MF A01 CSCL 08H

An overview is provided of activities of the Colorado Water Resources Research Institute during FY1981 - 1984. The report provides a summary of Institute programs for FY 1981 to 1984. Selected examples of completed research integrated basinwide water management; surface and groundwater management; groundwater recharge; urban drainage; computer-assisted water resources planning; urban water conservation; development of drought-tolerant crops; and water quality management for metal mining operations. GRA

N86-21975# Environmental Protection Agency, Atlanta, Ga.
FRESHWATER WETLANDS FOR WASTEWATER MANAGEMENT ENVIRONMENTAL ASSESSMENT HANDBOOK
Sep. 1985 516 p refs
(PB86-106564; EPA-904/9-85-135) Avail: NTIS HC A22/MF A01 CSCL 08H

The Freshwater Wetlands Handbook provides institutional, scientific and engineering guidance for the use of natural, freshwater wetlands for wastewater management. Wetlands have long been recognized for their pollutant removal capabilities and many have been used for wastewater management for some time. Little technical or institutional guidance currently exists for regulating these stems or for planning new systems. This Handbook provides guidance for state and federal regulatory agencies and potential dischargers evaluating wetlands for wastewater disposal or pollutant removal. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-21976 Northwestern Univ., Evanston, Ill.
STUDY OF MECHANISMS OF IONIC TRANSPORT IN CRYSTALLINE AND GLASSY SOLID ELECTROLYTES Ph.D. Thesis
Alexander Pechenik 1985 240 p
Avail: Univ. Microfilms Order No. DA8523571

Ionic conductivity in crystalline (beta'-alumina) and amorphous (beta-eucryptite glass) solid electrolytes has been investigated both theoretically (using Monte-Carlo computer simulation techniques) and experimentally. A powerful Monte Carlo technique has been developed and applied to study order-disorder transitions and transport properties (diffusion and frequency dependent conductivity) in beta'-alumina. The curvature of the Arrhenius plots of ionic conductivity observed experimentally has been explained on the basis of the order-disorder transition taking place in this system. Both long-range order (S) and short range order parameters have been calculated as functions of temperature. Also, the effects of mixing of mono- and divalent ions on the beta'-alumina typle lattice have been investigated. For the amorphous electrolyte (beta-eucryptite glass), the ionic conductivity has been measured using the complex impedance method and the structure of the glass has been elucidated using Raman and IR spectroscopy and X-ray diffraction. Dissert. Abstr.

N86-21977*# National Aeronautics and Space Administration, Washington, D.C.
THERMAL DEFORMATION OF CONCENTRATORS IN AN AXISYMMETRIC TEMPERATURE FIELD
R. Bairamov, Yu. I. Machuev, A. Nazarov, Ye. V. Sokolov, L. A. Solodovnikova, and V. G. Fokin Dec. 1985 12 p refs Transl. into ENGLISH from Akademiya Nauk Turkmenskoy SSR, Izvestiya, Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk (USSR), no. 2, 1981 p 26-31 Original language document was announced in IAA as A81-32157 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77935; NAS 1.15:77935) Avail: NTIS HC A02/MF A01 CSCL 10A

Axisymmetric thermal deformations of paraboloid mirrors, due to heating, are examined for a mirror with a optical axis oriented toward the Sun. A governing differential equation is derived using Mushtari-Donnel-Vlasov simplifications, and a solution is presented which makes it possible to determine the principal deformation characteristics. Author

N86-21978*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIGHTWEIGHT NICKEL ELECTRODE FOR NICKEL HYDROGEN CELLS AND BATTERIES
Doris L. Britton [1986] 10 p refs Presented at the 32nd International Power Sources Symposium, Cherry Hill, N.J., 9-12 Jun. 1986; sponsored by Army
(NASA-TM-87253; E-2942; NAS 1.15:87253) Avail: NTIS HC A02/MF A01 CSCL 10C

The nickel electrode was identified as the heaviest component of the nickel hydrogen (NiH2) battery. The NASA Lewis Research Center is developing nickel electrodes for NiH2 battery devices which will be lighter in weight and have higher energy densities when cycled under a low Earth orbit regime at deep depths of discharge. Lightweight plaques are first exposed to 31 percent potassium hydroxide for 3 months to determine their suitability for use as electrode substrates from a chemical corrosion standpoint. Pore size distribution and porosity of the plaques are then measured. The lightweight plaques examined are nickel foam, nickel felt, nickel plastic and nickel plated graphite. Plaques are then electrochemically impregnated in an aqueous solution. Initial characterization tests of the impregnated plaques are performed at five discharge levels, C/2, 1.0 C, 1.37 C, 2.0C, and 2.74 C rates. Electrodes that passed the initial characterization screening test will be life cycle tested. Lightweight electrodes are approximately 30 to 50 percent lighter in weight than the sintered nickel electrode. Author

N86-21979*# TriSolar Corp., Bedford, Mass.
DEVELOPMENT OF A MICROPROCESSOR CONTROLLER FOR STAND-ALONE PHOTOVOLTAIC POWER SYSTEMS Final Report
Alan R. Millner and David L. Kaufman Jun. 1984 192 p
(Contracts DEN3-310; DE-AI01-79ET-20485)
(NASA-CR-174723; DOE/NASA/0310-1; NAS 1.26:174723) Avail: NTIS HC A09/MF A01 CSCL 10B

A controller for stand-alone photovoltaic systems has been developed using a low power CMOS microprocessor. It performs battery state of charge estimation, array control, load management, instrumentation, automatic testing, and communications functions. Array control options are sequential subarray switching and maximum power control. A calculator keypad and LCD display provides manual control, fault diagnosis and digital multimeter functions. An RS-232 port provides data logging or remote control capability. A prototype 5 kW unit has been built and tested successfully. The controller is expected to be useful in village photovoltaic power systems, large solar water pumping installations, and other battery management applications. Author

N86-21980*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE AGING CORRELATION (RH + t): RELATIVE HUMIDITY (%) + TEMPERATURE (DEG C)
E. F. Cuddihy 15 Jan. 1986 22 p refs
(JPL Proj. 5101-283; Contract DE-AI01-85CE-89008)
(NASA-CR-176661; JPL-PUB-86-7; DOE/JPL-1012-121; NAS 1.26:176661) Avail: NTIS HC A02/MF A01 CSCL 10A

An aging correlation between corrosion lifetime, and relative humidity RH (%) and temperature t (C) has been reported in the literature. This aging correlation is a semi-log plot of corrosion lifetime on the log scale versus the interesting summation term [RH(%) + t(C)] on the linear scale. This empirical correlation was derived from observation of experimental data trends and has been referred to as an experimental law. Using electrical resistivity data of polyvinyl butyral (PVB) measured as a function of relative humidity and temperature, it was found that the electrical resistivity could be expressed as a function of the term [RH(%) t(C)]. Thus, if corrosion is related to leakage current through an organic insulator, which, in turn, is a function of RH and t, then some partial theoretical validity for the correlation is indicated. This article describes the derivation of the term [RH(%) t(C)] from PVB electrical resistivity data. Author

N86-21981*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH BAND GaP 3-5 TUNNELING JUNCTION FOR SILICON MULTIJUNCTION SOLAR CELLS Patent Application
Taher Daud (JPL, Pasadena, Calif.) and Akaram H. Kachare, inventors (to NASA) (JPL, Pasadena, Calif.) Filed 17 Dec. 1985 11 p
(Contract NAS7-918)
(NASA-Case-NPO-16526-1CU; NAS 1.71:NPO-16526-1CU; US-Patent-Appl-SN-809975) Avail: NTIS HC A02/MF A01 CSCL 10A

A multijunction silicon solar cell of high efficiency is provided by providing a tunnel junction between the solar cell junctions to connect them in series. The tunnel junction is comprised of p(+) and n(+) layers of high band gap 3 to 5 or 2 to 6 semiconductor materials that match the lattice structure of silicon, such as GaP (band gap 2.24 eV) or ZnS (band gap 3.6 eV), each of which has a perfect lattice match with silicon to avoid defects normally associated with lattice mismatch. NASA

N86-21982*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIRBORNE TRACKING SUN PHOTOMETER APPARATUS AND SYSTEM Patent Application
Tak Matsumoto, Cesar Mina, Philip Russell, and William VanArk, inventors (to NASA) Filed 29 Jan. 1986 17 p
(NASA-Case-ARC-11622-1; NAS 1.71:ARC-11622-1; US-Patent-Appl-SN-823712) Avail: NTIS HC A02/MF A01 CSCL 10A

An airborne tracking Sun photometer apparatus has a rotatable dome. An aximuth drive motor is connected to rotate the dome. The dome has an equatorial slot. A cylinderical housing is pivotally mounted inside the dome at the equatorial slot. A photometer is mounted in the housing to move in the equatorial slot as the housing pivots. The photometer has an end facing outward from the slot with an optical flat transparent window. An elevation drive motor is connected to pivot the cylindrical housing. The rotatable dome is mounted in bulkhead of an aircraft to extend from the interior of the aircraft. A Sun sensor causes the photometer to track the Sun automatically. Alternatively, the photometer may be oriented manually (by voltages or by computer). NASA

N86-21983# European Space Agency, Paris (France).
SOLAR ENERGY 85: RESOURCES, TECHNOLOGIES, ECONOMICS
W. R. Burke, comp. Nov. 1985 229 p refs Proceedings of Summer School Papers, Igls, Austria; organized by Austrian Solar and Space Agency, and DFVLR; sponsored by ESA, Swiss Federal Office of Energy and Swedish Council for Building Research
(ESA-SP-240; ISSN-0379-6566) Avail: NTIS HC A11/MF A01

The physics and potential of solar energy; solar energy and insulation; collection and storage of solar energy; process heat and chemicals; photochemistry and hydrogen; solar power plants and photovoltaics; technology assessment and space applications; and the place of solar energy in energy policies were discussed. For individual titles, see N86-21984 through N86-21997.

N86-21984# Ludwig-Maximilians-Universitaet, Munich (West Germany).
SOLAR RADIATIVE ENERGY
Rudolf Sizmann *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 5-16 refs (For primary document see N86-21983 12-44)
Avail: NTIS HC A11/MF A01

Solar radiation conversion into heat, and electrical and chemical energy is discussed. The theoretical limits of energy conservation along these conversion paths are considered. Thermal conversion is improved by use of optically selective absorbers. There are fundamental analogies between photovoltaics, photochemical and (optically selective) photothermal processes. Natural photosynthesis is taken as an example for a balance of energy yield from solar irradiance. Author (ESA)

N86-21985# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany).
THE OTHER ASPECT OF SOLAR ENERGY UTILIZATION. SOLAR TECHNOLOGIES EXPORT ENHANCEMENT: A CENTRAL EUROPEAN POINT OF VIEW
C.-J. Winter, J. Nitsch, H. Klaiss, and C. Voigt *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 17-31 refs (For primary document see N86-21983 12-44)
Avail: NTIS HC A11/MF A01

It is shown that solar energy utilization can, on a moderate scale, supplement the indigenous energy supply of the Federal Republic of Germany. It can contribute to the prevention of fatal ecological damage, open an attractive export market and, in the long run, prepare ground for North-South compensation, where energy-poor but technology rich countries cooperate with countries of the Third World, which are often rich in raw materials and are situated in the solar belt of the world, for the benefit of the implementation of a solar industry or the production of a marketable synthetic solar energy carrier. Author (ESA)

N86-21986# European Space Agency, Paris (France).
PASSIVE AND HYBRID SOLAR SYSTEMS
S. Robert Hastings (EMPA, Dubendorf, Switzerland) *In its* Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 35-43 refs Sponsored by Swiss Federal Energy Office, Bern, and Swiss National Energy Research Foundation, Basel (For primary document see N86-21983 12-44)
Avail: NTIS HC A11/MF A01

Passive solar systems are introduced. The four most common types of system are direct gain windows, air collectors, mass walls, and sunspaces. For each system type the concept, an example, design considerations, calculation methods, performance data, and suggested reading are presented. Conclusions are valid for central and to an extent for northern Europe. Author (ESA)

N86-21987# Wuerzburg Univ. (West Germany). Inst. fuer Physik.

TRANSPARENT SUPERINSULATING MATERIALS: NEW ASPECTS IN SOLAR TECHNOLOGY

J. Fricke *In* ESA Solar Energy 85: Resources, Technol., Econ. Nov. 1985 p 45-52 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Silica aerogel utilization in architecture is discussed. Silica aerogel is a solid inorganic material of high porosity with an open microstructure smaller than the wavelength of visible light. It is made from tetramethoxysilane, which is catalytically converted into an alcogel. Supercritical drying in an autoclave produces transparent aerogel tiles or translucent aerogel granulate. Aerogel has a small Young's modulus (1 to 10 million N/sq m) and can be mechanically loaded with 200,000 N/sq m. Evacuated aerogel provides excellent thermal insulation at 300 K (thermal conductivity 0.008 W/(m.K)) and this is suitable as a spacer in windows or in covers for passive solar systems. Author (ESA)

N86-21988# Philips G.m.b.H., Aachen (West Germany). Forschungslab.

SOLAR SYSTEMS WITH HIGHLY EFFICIENT COLLECTORS

B. Vitt *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 55-61 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Seasonal performance data of solar thermal systems are reported. For southern and middle European climatic conditions, systems with constant operating temperature, two types of a domestic hot water system, as well as a space heating system were evaluated. The results are related to the thermo-optical properties of the collectors. A heat pipe evacuated tubular collector was examined. The impact of the optimization of the selective absorber coating on performance was studied. It is concluded that optimized evacuated tube collectors can be used to generate heat at temperatures > 200 C. Author (ESA)

N86-21989# Studsvik Energiteknik A.B., Nykoping (Sweden).

DISTRICT HEATING BY SOLAR ENERGY WITH HEAT STORAGE

Heimo Zinko *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 63-82 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Solar district heating in middle and northern European climates is discussed. Well performing collectors can easily be directly applied for producing 10% to 15% of the yearly energy needs in district heating systems. It can be shown that the introduction of small daily storage is beneficial for the load management of the total system. This holds even more if long term storage is introduced for systems with solar fractions > 30%. Solar energy systems with different types of storage and an economic outlook based on Swedish experience are outlined. Author (ESA)

N86-21990# Ludwig-Maximilians-Universitaet, Munich (West Germany).

PROCESS HEAT APPLICATIONS

Rudolf Sizmann *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 85-91 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Conversion of solar energy into industrial process heat is discussed. The demand for industrial process heat energy exhibits distinct regimes of maximum usage: at medium temperatures, i.e., < 300 C, and 1150 C. Solar radiation converted to process heat energy can be used as fuel saver but also for solar unique applications: direct absorption, uncommonly high temperatures, and photocatalytic promotion of thermochemical reactions. The fluctuating input causes logistics and materials problems. Thermochemical reactions under consideration for pilot tests are mentioned. Author (ESA)

N86-21991# Bern Univ. (Switzerland). Dept. of Inorganic and Physical Chemistry.

PHOTOCHEMICAL, ELECTROCHEMICAL AND THERMOCHEMICAL TRANSFORMATION AND STORAGE OF SOLAR ENERGY: THERMODYNAMIC ASPECTS

Gion Calzaferri *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 93-100 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Arguments of the reversible and irreversible chemical thermodynamics are explained and applied to the transfer and storage of solar energy chemical and radiation potential. The key processes are identified as water splitting, carbon dioxide reduction and nitrogen reduction. Results on photochemical storage processes are reported. Author (ESA)

N86-21992# Technische Univ., Vienna (Austria). Inst. for Theoretical Chemistry and Radiation Chemistry.

CRITICAL VIEW OF PHOTOCHEMICAL AND PHOTOELECTROCHEMICAL METHODS FOR HYDROGEN PRODUCTION

Nikola Getoff *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 103-114 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Methods for hydrogen production by water splitting using solar energy are reviewed. Water photolysis and solar radiation; homogeneous and heterogeneous photoredox sysems; photogalvanic cells; liquid-junction transducers; and hybrid water splitting systems are discussed. Results concerning the reaction mechanisms of decomposition reactions are presented. The most promising systems for hydrogen production by solar energy seem to be liquid-junction transducers and hybrid systems. Author (ESA)

N86-21993# Joint Research Centre of the European Communities, Ispra (Italy).

ROLE OF HYDROGEN IN SOLAR ENERGY UTILIZATION: PROBLEMS AND ASPECTS OF THE HYDROGEN ISSUE

J. Gretz *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 115-127 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

The thermodynamics of water splitting is reviewed. A hydrogen-based, clean energy supply concept comprising the production of hydrogen by hydropower, its transportation to Europe, and its storage and use in different forms is described. The economic aspects are treated. Author (ESA)

N86-21994# Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland).

EXPERIENCES WITH SOLAR POWER

P. Kesselring *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 131-144 refs (For primary document see N86-21983 12-44)

Avail: NTIS HC A11/MF A01

Experience with solar thermal plants is reviewed. The component and subsystems development of the last decade and particularly the receiver, collector and heliostat field development is a technical success. Solar specific problems on the system and component level arose, when off the shelf solutions of fossile fired plants were transferred uncritically. It is shown that concentrated solar radiation is a relatively cheap high quality fuel. Other uses than electricity generation are high temperature processes and the production of solar fuels and chemicals. A

technical and economic comparison of solar thermal and photovoltaic electricity generation is made. Author (ESA)

N86-21995# Fraunhofer-Inst. fuer Systemtechnik und Innovationsforschung, Karlsruhe (West Germany).
TECHNOLOGY ASSESSMENT OF SOLAR ENERGY UTILIZATION
F. Jaeger *In* ESA Solar Energy 85: Resources, Technologies, Economies Nov. 1985 p 147-151 refs Sponsored by Deutsche Forschungsgemeinschaft (For primary document see N86-21983 12-44)
Avail: NTIS HC A11/MF A01

The general objectives and methods of Technology Assessment (TA) are outlined. Typical analysis steps of a TA for solar energy are reviewed: description of the technology and its further development; identification of impact areas; analysis of boundary conditions and definition of scenarios; market penetration of solar technologies; projection of consequences in areas of impact; and assessment of impacts and identification of options for action. Author (ESA)

N86-21996# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SPACE APPLICATIONS OF SOLAR ENERGY SYSTEMS
K. Bogus and D. Kassing *In its* Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 153-167 refs (For primary document see N86-21983 12-44)
Avail: NTIS HC A11/MF A01

Space solar energy systems are reviewed. The European technology development program is discussed. Interactions with non-European space programs, and interactions with the development of terrestrial photovoltaics are considered. Author (ESA)

N86-21997# Austrian Solar and Space Agency, Vienna.
SOLAR ENERGY: ONE DECADE OF RESEARCH AND APPLICATION, REVIEW AND OUTLOOK
G. Faninger *In* ESA Solar Energy 85: Resources, Technologies, Economics Nov. 1985 p 205-211 (For primary document see N86-21983 12-44)
Avail: NTIS HC A11/MF A01

The state of the art of solar technologies, and the problems opposing their large-scale market introduction are described. Hydrogen production, heat generation, and electricity production are considered. Author (ESA)

N86-21998# Naval Weapons Center, China Lake, Calif.
GEOTHERMAL POTENTIAL OF ADAK ISLAND, ALASKA Interim Report, 1976 - 1982
Allan M. Katzenstein and James A. Whelan Oct. 1985 93 p
(AD-A161824; AD-E900526; NWC-TP-6676) Avail: NTIS HC A05/MF A01 CSCL 08/7

The U.S. Naval Station, Adak, Alaska, is dependent on JP-5 jet fuel for all power and space heating requirements. In the Navy's continuing program to explore alternative energy sources, investigations have been undertaken into the geothermal potential of Adak Island. Extensive geological, geophysical, and geochemical investigations and the results obtained from drilling observation holes indicated that a geothermal potential exists. Further drilling should be accomplished to verify whether an economic geothermal resource can be developed. GRA

N86-21999# Naval Weapons Center, China Lake, Calif.
COSO: EXAMPLE OF A COMPLEX GEOTHERMAL RESERVOIR Final Report, 1984 - 1985
Carl F. Austin and William F. Durbin Sep. 1985 101 p
(Z08-29)
(AD-A162575; AD-E900521; NWC-TP-6658) Avail: NTIS HC A06/MF A01 CSCL 08/7

The Coso geothermal system has been widely studied and reported by scientists through the past several years, but there is still a considerable divergence of opinion regarding the structural setting, origin, and internal structure of this energy resource. Because of accelerating exploration and development drilling that is taking place, there is a need for a reservoir model that is consistent with the limited geologic facts available regarding the area. GRA

N86-22000# Sandia National Labs., Albuquerque, N. Mex.
OPTICAL EFFECTS OF THIN FILM ADHESIVES IN MECHANICALLY STACKED MULTIJUNCTION SOLAR CELLS
R. B. Siegel 1985 8 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001620; SAND-85-1160C; CONF-851043-4) Avail: NTIS HC A02/MF A01

The use of multijunction solar cells allows an increased utilization of the solar spectrum and thereby increases cell efficiency. The optical coupling of cells with different bandgaps used in a mechanically stacked configuration, however, causes some concern since the gains from the bottom cell can be effectively negated by reflectance losses between the cells. A short outline of the theory of thin film optics as applied to this situation is presented. Theoretical reflectances of single and multiple layer adhesives between AlGaAs and Si cells are developed. An option currently being investigated for a series connected multijunction cell is illustrated. The multijunction cell with multilayer adhesives could have less than 2% reflectance loss between the cells. This compares most favorably to the 25% reflectance loss of thick adhesive layers. DOE

N86-22001# Sandia National Labs., Albuquerque, N. Mex.
TEST DATA ANALYSIS FOR CONCENTRATING PHOTOVOLTAIC ARRAYS
A. B. Maish and J. E. Cannon 1985 7 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-001623; SAND-85-1150C; CONF-851043-3) Avail: NTIS HC A02/MF A01

A test data analysis approach for use with steady state efficiency measurements taken on concentrating photovoltaic arrays is presented. The analysis procedures can be used to identify based and erroneous data. The steps involved in analyzing the test data are screening the data, developing coefficients for the performance equation, analyzing statistics to ensure adequacy of the regression fit to the data, and plotting the data. In addition, this paper analyzes the sources and magnitudes of precision and bias errors that affect measurement accuracy are analyzed. DOE

N86-22002# Public Service Electric and Gas Co., Newark, N. J.
UTILITY CYCLE TESTING OF A 500-kWh ZINC CHLORIDE BATTERY AT THE BATTERY ENERGY STORAGE TEST (BEST) FACILITY Final Report
E. A. Hyman Oct. 1985 88 p
(Contract DE-AC02-76ET-29368)
(DE86-001598; EPRI-EM-4295) Avail: NTIS HC A05/MF A01

A 500-kWh zinc chloride battery test system completed an entire schedule of 80 simulated utility and customer application cycles - the most diverse and severe known to be successfully performed by any advanced battery system. Encouraged by these results, researchers plan to have a 2-MW demonstration battery system ready for testing in 1986. DOE

N86-22003# Pacific Northwest Lab., Richland, Wash.
OPPORTUNITIES IN PULSE COMBUSTION
D. L. Brenchley and H. J. Bomelburg Oct. 1985 24 p
(Contract DE-AC06-76RL-01830)
(DE86-001436; PNL-5563) Avail: NTIS HC A02/MF A01

In most pulse combustors, the combustion occurs near the closed end of a tube where inlet valves operate in phase with the pressure amplitude variations. Thus, within the combustion zone, both the temperature and the pressure oscillate around a mean value. However, the development of practical applications of pulse combustion has been hampered because effective design requires the right combination of the combustor's dimensions, valve characteristics, fuel/oxidizer combination, and flow pattern. Pulse

combustion has several additional advantages for energy conversion efficiency, including high combustion and thermal efficiency, high combustion intensity, and high convective heat transfer rates. Also, pulse combustion can be self-aspirating, generating a pressure boost without using a blower. This allows the use of a compact heat exchanger that may include a condensing section and may obviate the need for a chimney. In the last decade, these features have revived interest in pulse combustion research and development, which has resulted in the development of a pulse combustion air heater by Lennox, and a pulse combustion hydronic unit by Hydrotherm, Inc. To appraise this potential for energy savings, a systematic study was conducted of the many past and present attempts to use pulse combustion for practical purposes. The authors recommended areas where pulse combustion technology could possibly be applied in the future and identified areas in which additional R and D would be necessary. Many of the results of the study project derived from a special workshop on pulse combustion. This document highlights the main points of the study report, with particular emphasis on pulse combustion application in chemical engineering. DOE

N86-21726# Joint Publications Research Service, Arlington, Va.
TDK AFFILIATE DEVELOPS NEW SOLAR POWER CELL
In its Japan Report: Science and Technology (JPRS-JST-86-001) 10 Jan. 1986 p 52 Repr. from Kyodo (Tokyo, Japan), 0727 GMT, 21 Nov. 1985 (For primary document see N86-21723 12-31) Avail: NTIS HC A04/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-22004# Institute for Defense Analyses, Alexandria, Va.
NUCLEAR WINTER: SMOKE GENERATION, DEPOSITION, AND REMOVAL Final Report
Ernest Bauer Dec. 1984 118 p
(Contract MDA903-84-C-0031)
(AD-A161807; AD-E500730; IDA-M-24; IDA/HQ-84-29173) Avail: NTIS HC A06/MF A01 CSCL 18/3

The Nuclear Winter scenario predicts a major worldwide cooling arising from the large quantities of soot deposited in the atmosphere from fires ignited by the explosions in a large nuclear exchange. This document reviews the source function for smoke associated with urban and forest fires, addressing the smoke composition and predicted smoke cloud rise height. The interaction of the smoke cloud with the atmosphere is complex and depends on weather conditions. Results from past forest fires demonstrate what can actually happen to smoke clouds. GRA

N86-22005# Weston (Roy F.), Inc., West Chester, Pa.
INSTALLATION RESTORATION GENERAL ENVIRONMENTAL TECHNOLOGY DEVELOPMENT. TASK 6: MATERIALS HANDLING OF EXPLOSIVE CONTAMINATED SOIL AND SEDIMENT Final Report, Jan. 1984 - Jan. 1985
Lawrence J. Bove, M. Ramanathan, John W. Noland, and Peter J. Marks Jun. 1985 113 p
(Contract DAAK11-82-C-0017)
(AD-A162516; AMXTH-TE-TR-85010) Avail: NTIS HC A06/MF A01 CSCL 13/2

Past practices at explosives manufacturing and handling facilities have resulted in contaminated soils and lagoon sediments. Treatment and handling procedures will result in numerous safety concerns due to the potentially reactive nature of these materials. This report discusses development of typical materials handling processes from removal of soils/sediments from a particular site to feed into a treatment of disposal process. Sensitivity testing was reviewed to enable recommendations for complete analysis of contaminated soils. Materials handling techniques, including state-of-the-art explosives handling and other adaptable solids handling techniques, were compiled into four application categories: excavation/removal, transport, conditioning/storage, and feed. This includes a process description, potential sources of ignition inherent to equipment operation, applicability of differing site characteristics, and possible design and operating modifications to reduce the potential for ignition. A protocol for handling contaminated soils and sediments was developed. Initially each site will undergo a detailed site categorization which will include site assessment, field sampling with chemical analysis, and a sensitivity testing program. GRA

N86-22006# Weston (Roy F.), Inc., West Chester, Pa.
INSTALLATION RESTORATION GENERAL ENVIRONMENTAL TECHNOLOGY DEVELOPMENT. TASK 8: BENCH-SCALE INVESTIGATION OF LOW TEMPERATURE THERMAL REMOVAL OF TCE (TRICHLOROETHYLENE) FROM SOIL Final Report, Jun. 1984 - Feb. 1985
W. P. Lambert, L. J. Bove, D. Burkitt, S. Birk, and D. Russell Mar. 1985 111 p
(Contract DAAK11-82-C-0017)
(AD-A162528; AMXTH-TE-TR-85004) Avail: NTIS HC A06/MF A01 CSCL 13/2

Bench-scale studies were performed to demonstrate the viability of the concept of low temperature thermal volatilization of TCE from soils. A factorial experimental design using multi-way Analysis of Variance (ANOVA) for data analysis was employed. Factors were type of soil (3 levels), TCE concentration (2 levels), operating temperature (3 levels), and moisture content (2 levels). Duplicates were run. TCE can be stripped from contaminated soils under the conditions of this study. Varying amount of TCE were not stripped from the tested soil at all experimental conditions at temperatures less than 120 degrees C. The content of these residuals was verified by independent analysis to be TCE. Only TCE was displayed as output traces by the experimental apparatus. All of the experimental factors and each of their binary combination were statistically significant to the magnitude of TCE residual concentrations. Operating temperature was the dominant factor. Engineering data implications based on experimental results are: Operating temperatures for pilot-scale equipment should be greater than or equal to 120 degrees C for complete removal of TCE in less than 20 minutes. Pilot-scale equipment should be of sufficient flexibility to permit verification of the results of this study and experimentation to optimize operating parameters. GRA

N86-22007# Oak Ridge National Lab., Tenn.
OPERATING RESEARCH PLAN. VOLUME 2: INVENTORY OF RESEARCH UNDER THE NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM
G. M. Caton, J. M. Riordan, and C. Oen 1984 561 p
(Contract DE-AC05-84OR-21400)
(DE86-001593; DOE/OR-21400/T199) Avail: NTIS HC A24/MF A01

This document contains an appendix section for each research area and includes a detailed description of all ongoing and planned projects of the National Program with the performer(s), duration, funding, study area, research objectives, methodologies, and expected outputs. This information is also recorded in the National Program's on-line computer inventory of research activities, which is frequently updated by the National Program managers. DOE

N86-22008# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Inst. fuer Strahlenschutz.
RESULTS OF LARGE-SCALE ENVIRONMENT MONITORING OF THE SEIBERSDORF AUSTRIAN RESEARCH CENTER [ERGEBNISSE DER GROSSRAEUMIGEN UMGEBUNGSUEBERWACHUNG DES OESTERREICHISCHEN FORSCHUNGSZENTRUMS SEIBERSDORF]
Herbert Sorantin, Karl Irlweck, and Ferdinand Steger Jun. 1985 27 p refs In GERMAN; ENGLISH summary Presented at OEVS/OESRAD Fruehjahrstagung 1985, 22 May 1985
(OEFZS-4324; ST-132/85) Avail: NTIS HC A03/MF A01

Environment contamination and radiation around an 8mw research reactor, incineration plant, and radionuclide laboratories

were investigated, using air, water, ground and biological material radioactivity analysis, and external radiation determination. Natural background radiation in the region is higher than in the research center surroundings. Neither environment contamination nor increased external environment radiation is shown. Author (ESA)

N86-22009# Stockholm Univ. (Sweden). Dept. of Meteorology.
INVENTORY OF RESEARCH GRADE AIR MONITORING STATIONS OPERATED BY EUROPEAN RESEARCH GROUPS
J. Heintzenberg and B. Moberg Oct. 1985 41 p refs
(AP-25; ISSN-0280-4441) Avail: NTIS HC A03/MF A01

Logistic information and measuring programs at 21 air monitoring stations in (or operated by) 9 countries are reported. Eight of the stations are located off the European subcontinent, four in the European Arctic sector, one off the African coast and three in the Southern Hemisphere. Author (ESA)

N86-22010# GCA Corp., Bedford, Mass.
NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM EMISSION INVENTORY ALLOCATION FACTORS Final Report
F. M. Sellars, T. E. Fitzgerald, L. M. Lennon, L. J. Maiocco, and N. M. Monzione Sep. 1985 181 p refs Sponsored in part by Energy Engineering Research Lab.
(Contract EPA-68-02-3698)
(PB86-104247; GCA-TR-84-171-G; EPA-600/7-85-035) Avail: NTIS HC A09/MF A01 CSCL 13B

This report describes the processes, assumptions, and data sources used in developing the National Acid Precipitation Assessment Program (NAPAP) temporal, spatial, and species allocation factors. The processing of the NAPAP emissions inventory through the Regional Model Data Handling System (RMDHS) and the specifications for a new NAPAP data handling system are also detailed. The Eulerian acid deposition model being developed for use in the NAPAP required more resolved emissions data than are available in the NAPAP emissions inventory. The NAPAP inventory, which separately covers annual emissions from point and county-wide area sources, had to be apportioned to reflect hourly emissions with area source emissions assigned to grid squares. Hourly emissions of volatile organic compounds (VOCs) then had to be allocated into photochemical reactivity classes and nitrogen oxides (NOx) emissions had to be separated into NO and NO2. GRA

N86-22011# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
QUALITY ASSURANCE FOR THE ACID PRECIPITATION MEASUREMENT PROGRAM IN THE US
P. L. Finkelstein Sep. 1985 8 p ref
(PB86-107034; EPA-600/D-85-197) Avail: NTIS HC A02/MF A01 CSCL 14B

The U.S. National Atmospheric Deposition Program (NADP) is a confederation of scientists, universities, and government agencies formed with the common interest of measuring acid rain in the United States. In order to insure that the data developed under this program are reliable, a quality assurance program was developed. This report reviews the major aspects of the NADP Quality Assurance Plan, including field operations, laboratory activities, and data handling. Author (GRA)

N86-22012# National Oceanic and Atmospheric Administration, Rockville, Md. National Marine Pollution Program Office.
INVENTORY OF NON-FEDERALLY FUNDED MARINE POLLUTION RESEARCH, DEVELOPMENT AND MONITORING ACTIVITIES: GREAT LAKES REGION
M. E. Monaco May 1985 124 p
(PB86-102308) Avail: NTIS HC A06/MF A01 CSCL 06T

Information concerning marine pollution research and monitoring programs currently being undertaken is an important factor in helping plan and guide national efforts to control such pollution. Projects listed in the report concern only marine pollution research, development, and monitoring activities. Research projects include studies, investigations, and surveys of the behavior, fate, and effects of pollutants or potential pollutants. They may also concern natural oceanic processes related to pollutants and potential pollutants. GRA

N86-22013# Battelle Pacific Northwest Labs., Richland, Wash.
GREEN RIVER AIR QUALITY MODEL DEVELOPMENT. VALMET: A VALLEY AIR POLLUTION MODEL Final Report
C. D. Whiteman and K. J. Allwine Aug. 1985 185 p Sponsored in part by Environmental Protection Agency, Research Triangle Park, N. C.
(PB86-104106; PNL-4728; EPA-600/E-85-064) Avail: NTIS HC A09/MF A01 CSCL 07D

Following a thorough analysis of meteorological data obtained from deep valleys of western Colorado, a modular air pollution model was developed to simulate the transport and diffusion of pollutants released from an elevated point source in a well-defined mountain valley during the nighttime and morning transition periods. This initial version of the model, named VALMET, operates on a valley cross section at an arbitrary distance down-valley from a continuous point source. The model was constructed to include parameterizations of the major physical processes that act to disperse pollution during these time periods. The model was not fully evaluated. Further testing, evaluations, and development of the model are needed. Priorties for further development and testing are provided. GRA

N86-22014# PEI Associates, Inc., Durham, N.C.
USER'S GUIDE FOR THE MULTIPLE AIRSHED (MASH) MODEL
R. A. Paul Jul. 1985 34 p
(Contract EPA-68-02-3512)
(PB86-100146; EPA-450/4-85-009) Avail: NTIS HC A03/MF A01 CSCL 13B

Multiple airshed (MASH) model calculates design values for each of a series of ozone monitoring sites in the U.S. Each monitor is assigned to various airsheds, depending on time of day and the resultant wind direction for each day. Using a list of high values for each airshed, one design value is selected for each airshed and monitor combination. The design value associated with a particular SMSA can be selected from the resulting list of site specific design values which the program generates for each airshed. Input data for MASH are hourly ozone values from monitors, daily resultant wind directions at selected meteorological stations, and a coded set of instructions telling how to allocate hourly ozone values to various airsheds based on wind direction. GRA

N86-22015# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
INVESTIGATION OF TRANSIENT ASPECTS OF ATMOSPHERIC DISPERSION PROCESSES IN THE WAKE OF A BUILDING THROUGH VIDEO IMAGE ANALYSIS
A. H. Huber and S. P. S. Arya Sep. 1985 8 p Prepared in cooperation with North Carolina State Univ., Raleigh
(PB86-100989; EPA-600/D-85-217) Avail: NTIS HC A02/MF A01 CSCL 04A

The processing of continuous video images is now very feasible and applicable to the study of the transient nature of atmospheric transport and the highly variable pollutant concentrations near buildings. Research is now ongoing to best develop and refine appropriate methods of analysis. The present capabilities for video image analysis are summarized. GRA

N86-22016# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
EPA (ENVIRONMENTAL PROTECTION AGENCY) OXIDANT MODEL: DESCRIPTION AND EVALUATION PLAN
K. L. Schere and A. J. Fabrick Sep. 1985 92 p Prepared in cooperation with MEF Environmental, Inc., Austin, Tex.
(PB86-103090; EPA-600/3-85-067) Avail: NTIS HC A05/MF A01 CSCL 04A

The U.S. EPA Regional Oxidant Model (ROM) and NEROS data base are described. The mode incorporates a comprehensive description of the physical and chemical processes thought to be important to tropospheric O3 production on 1000 km scales. The

data base employed for the first application of the ROM was collected during the summers of 1979 and 1980 in the northeast U.S. It contains meteorological and air quality data from regular monitoring networks and from enhanced networks or special field project measurements during that period. The evaluation procedure that will be used to determine the ROM performance on this data base is outlined. A number of episodes will be simulated from the period July 23 through August16, 1980, for which performance statistics will be developed. The evaluation of any given day within an episode will proceed in two distinct stages. The first stage will focus on model performance for an individual model realization, irrespective of all other realizations. GRA

N86-22017# California Inst. of Tech., Pasadena. Lab. of Environmental Engineering Science.
CHARACTERIZATION OF REACTANTS, REACTION MECHANISMS AND REACTION PRODUCTS IN ATMOSPHERIC WATER DROPLETS: FOG, CLOUD, DEW AND RAIN WATER CHEMISTRY Final Report
M. R. Hoffmann, D. J. Jacob, J. M. Waldman, J. W. Munger, and R. C. Flagan Apr. 1985 278 p Sponsored in part by California State Air Resources Board, Sacramento
(Contract ARB-A2-048-32)
(PB86-107976; ARB-R-85/259) Avail: NTIS HC A13/MF A01 CSCL 04A

Analyses of ground based fogwater collected by inertial impaction in the Los Angeles basin, the San Gabriel Mountains, and the San Joaquin Valley revealed very high concentrations of NO3(-1), SO4(-2), NH4(+1), and other ions, often coupled with very high acidities. Fogs and stratus in the Los Angeles basin typically had pH values ranging from 2 to 4. Acidities were not as high in the San Joaquin Valley, mostly because of scavenging by the fogs of ammonia from agricultural sources. Deposition of fogwater was observed to be important pollutant sink during stagnation episodes in the San Joaquin Valley, and may also be an important source of acid input to surfaces in some areas. Kinetic experiments showed that H2O2 is important in the oxidation of S(IV) to S(VI) at low pH. Metal-catalyzed auto-oxidation could also be an important source of sulfate. However, the extreme acidities observed in fogs (below pH3) require condensation on preexistent acidic nuclei and scavenging of gaseous nitric acid. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-22018 Colorado Univ., Boulder.
ANALYSIS OF NITRIC OXIDE FLUORESCENCE BANDS FROM HIGH LATITUDE ROCKET OBSERVATIONS OF THE THERMOSPHERIC DAYGLOW
David Dempster Cleary 1985 165 p
Avail: Univ. Microfilms Order No. DA8522653

Ultraviolet spectra of the Earth's thermospheric dayglow are analyzed. Observations were made on August 10, 1982, from Poker Flats, Alaska, using a rocket-borne spectrometer that measured the wavelength range 1950 to 2170 A. This part of the spectrum is dominated by emissions from the gamma, delta, and epsilon bands of nitric oxide. Column densities of nitric oxide are determined by fitting these fluorescence bands with synthetic spectra. Below 125 km, the (1,0) and (2,0) gamma bands are self-absorbed due to the large NO column densities associated with the auroral zone, particularly when the measurements are made using a horizontally viewing instrument. Three bands of the weak NO epsilon system, (0,1), (0,2), and (0,3), were detected in this region of the spectrum. This is the first time these features were clearly resolved from spectra of the Earth's dayglow and positively identified with the epsilon system. The NO column density profile obtained from this analysis is compared with the results of a one dimensional photochemical model. A sensitivity analysis of the model shows that the data can be reproduced equally well over a range of these parameters. Dissert. Abstr.

N86-22019 Institut d'Aeronomie Spatiale de Belgique, Brussels.
PLASMOID MOTION ACROSS A TANGENTIAL DISCONTINUITY (WITH APPLICATION TO THE MAGNETOPAUSE)
J. Lemaire 1985 30 p refs Presented at Chapman Conference on Solar-Wind Magnetosphere Coupling, Pasadena, Calif., 12-15 Feb. 1984 Submitted for publication Sponsored by Belgian Ministry of National Education and Belgian Fonds National de la Recherche Scientifique
(Aeronomica-Acta-A-297-1985) Avail: Issuing Activity

The motion of a plasmoid across an inhomogeneous magnetic field distribution of which the direction and strength change along the penetration trajectory was studied. The bulk velocity decreases when the plasma element penetrates into a region of increasing magnetic field. The critical magnetic field intensity where a plasmoid is stopped or deflected is found to be the same critical field as observed in laboratory experiments for a nonrotating B-field distribution. The polarization electric field induced inside a moving plasma element for low and high beta plasmoids was determined. Impulsive penetration of solar wind plasma irregularities impinging on the Earth's geomagnetic field with an excess momentum density was analyzed. A plasma boundary layer is formed where the intruding plasmoids are deflected eastward. Magnetospheric plasma is dragged in the direction parallel to the flanks of the average magnetopause surface. Author (ESA)

N86-22020 Institut d'Aeronomie Spatiale de Belgique, Brussels.
DYNAMICAL PLASMAPAUSE POSITIONS DURING THE JULY 29-31/1977 STORM PERIOD: A COMPARISON OF OBSERVATIONS AND TIME DEPENDENT MODEL CALCULATIONS
Y. Corcuff (Poitiers Univ., France), P. Corcuff (Poitiers Univ., France), and J. Lemaire 1985 44 p refs Presented at 18th IAGA Meeting on the Role of Ionospheric Plasma in the Plasmasphere and Magnetosphere, Hamburg, West Germany, 17 Aug. 1983 Document previously announced in IAA as A86-18678 Submitted for publication Sponsored by CNRS and Belgian Fonds National de la Recherche Scientifique
(Aeronomica-Acta-A-299-1985) Avail: Issuing Activity

The temporal evolution of the plasmapause boundary was studied over a period of 3.5 days with substorms. The equatorial plasmapause position in different local time sectors was calculated as a function of universal time using electric field distributions derived from the models of Volland-Stern and McIlwain, with similar variation of the electric field intensity as a function of the Kp index. Model predictions were compared with data from a large number of whistlers, GEOS-1 in situ electron density measurements, and estimates of low-altitude plasmapause boundaries deduced from S3-3 satellite data. It is concluded that when the mechanism of plasma interchange motion is taken into account the calculated positions of the plasmapause fit the observations better than in the case of the classical MHD approximation. The time dependent E3H and Volland-Stern's electric field models satisfactorily describe a number of features. Author (ESA)

N86-22021 Institut d'Aeronomie Spatiale de Belgique, Brussels.
VERTICAL DISTRIBUTION OF ACETONITRILE IN THE ATMOSPHERE
J. Ingels, D. Nevejans, and E. Arijs 1985 13 p refs Presented at International Middle Atmosphere Program (MAP) Symposium 1984, Kyoto, Japan, 26-30 Nov. 1984 Submitted for publication
(Aeronomica-Acta-A-300-1985) Avail: Issuing Activity

The presence of acetonitrile in the atmosphere was confirmed by results of surface and stratospheric investigations. Stratospheric measurements give mixing ratios typically decreasing with height from 3 ppt at 25 km to 0.5ppt at 40 km. Measurements at the Earth's surface are less unanimous, although a ground level background mixing ratio of a few times 10ppt seems realistic. Measurements are compatible with a small global surface source of acetonitrile and a small tropospheric loss. The vertical distribu-

tion of acetonitrile presented is consistent with general knowledge of composition and chemistry of the atmosphere. Author (ESA)

N86-22022*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARATIVE ACCURACY OF THE ALBEDO, TRANSMISSION AND ABSORPTION FOR SELECTED RADIATIVE TRANSFER APPROXIMATIONS
Michael D. King and Harshvardhan Jan. 1986 47 p refs
(Grant NAG5-309)
(NASA-RP-1160; Rept-86B0034; NAS 1.61:1160) Avail: NTIS HC A03/MF A01 CSCL 04A

Illustrations of both the relative and absolute accuracy of eight different radiative transfer approximations as a function of optical thickness, solar zenith angle and single scattering albedo are given. Computational results for the plane albedo, total transmission and fractional absorption were obtained for plane-parallel atmospheres composed of cloud particles. These computations, which were obtained using the doubling method, are compared with comparable results obtained using selected radiative transfer approximations. Comparisons were made between asymptotic theory for thick layers and the following widely used two stream approximations: Coakley-Chylek's models 1 and 2, Meador-Weaver, Eddington, delta-Eddington, PIFM and delta-discrete ordinates. Author

N86-22023*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE MSFC/J70 ORBITAL ATMOSPHERE MODEL AND THE DATA BASES FOR THE MSFC SOLAR ACTIVITY PREDICTION TECHNIQUE
Dale L. Johnson and Robert E. Smith Nov. 1985 42 p refs
(NASA-TM-86522; NAS 1.15:86522) Avail: NTIS HC A03/MF A01 CSCL 04A

The MSFC/J70 Orbital Atmospheric Density Model, a modified version of the Smithsonian Astrophysical Observatory Jacchia 1970 model is explained. The algorithms describing the MSFC/J70 model are included as well as listing of the computer program. The 13-month smoothed values of solar flux (F sub 10.7) and geomagnetic index (S sub p), which are required as inputs for the MSFC/J70 model, are also included and discussed. Author

N86-22024*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSING THE CAPABILITY OF EOS SENSORS IN MEASURING OCEAN-ATMOSPHERE MOISTURE EXCHANGE
W. Timothy Liu 15 Dec. 1985 26 p refs
(Contract NAS7-918)
(NASA-CR-176658; JPL-PUB-85-93; NAS 1.26:176658) Avail: NTIS HC A03/MF A01 CSCL 04A

As part of the Science Synergism Studies to identify interdisciplinary Scientific studies, which could be addressed by the Environmental Observing System (EOS), the techniques being developed to measure ocean-atmosphere moisture exchanges using satellite sensors were evaluated. Studies required to use sensors proposed for EOS were examined. A method has been developed to compute the moisture flux using the wind speed, sea surface temperature, and preciptable water measured by satellite sensors. It relies on a statistical model which predicts surface-level humidity from precipitable water. The Scanning Multichannel Microwave Radiometer (SMMR) measures all 3 parameters and was found to be sensitive to the annual cycle and large interannual variations such as the 1982 to 1983 El Nino. There are systematic differences between geophysical parameters measured by Nimbus/SMMR and in situ measurements. After quadratic trends and crosstalks were removed from the parameters through multivariate regressions, the latent heat fluxes computed from SMMR agree with those computed from ship reports to within 30 W/sq m. The poor quality of ship reports may be the cause of a portion of this scatter. Similar results are found using SEASAT/SMMR data. When the scatterometer winds were used instead of the SMMR winds, the difference between the satellite fluxes and the ship fluxes was reduced. Author

N86-22025# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATMOSPHERIC ELECTRIC FIELDS: A NUMERICAL APPROACH
S. L. G. Dutra, A. E. C. Pereira (Univ. Federal de Uberlanica-UFU, Uberlandia, Brazil), A. L. C. Gonzalez, and W. D. Gonzalez Nov. 1985 33 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication
(INPE-3704-PRE/844) Avail: NTIS HC A03/MF A01

In this work some numerical methods for the resolution of the atmospheric electric potential equation are presented and discussed. Some applications related to different sources of the atmospheric electric potential for equatorial latitudes are also given. Author

N86-22026*# Illinois Univ., Urbana. Aeronomy Lab.
ROCKET EXPERIMENTS FOR SPECTRAL ESTIMATION OF ELECTRON DENSITY FINE STRUCTURE IN THE AURORAL AND EQUATORIAL IONOSPHERE AND PRELIMINARY RESULTS
B. A. Tomei and L. G. Smith 1 Jan. 1986 164 p refs
(Grant NGR-14-005-181)
(NASA-CR-176648; NAS 1.26:176648; Aeronomy-119; ISSN-0568-0581) Avail: NTIS HC A08/MF A01 CSCL 04A

Sounding rockets equipped to monitor electron density and its fine structure were launched into the auroral and equatorial ionosphere in 1980 and 1983, respectively. The measurement electronics are based on the Langmuir probe and are described in detail. An approach to the spectral analysis of the density irregularities is addressed and a software algorithm implementing the approach is given. Preliminary results of the analysis are presented. Author

N86-22027# Stockholm Univ. (Sweden). Dept. of Meteorology.
PROCEEDINGS OF THE 12TH ANNUAL MEETING ON ATMOSPHERIC STUDIES BY OPTICAL METHODS
Georg Witt, ed. 15 Aug. 1985 271 p refs Proceedings held in Stockholm, 3-7 Sep. 1984
(Contract SWED-NSRC-O-TA-2628-118)
(AP-23; ISSN-0280-4441) Avail: NTIS HC A12/MF A01

Auroral spectroscopy and aeronomy; atmospheric interferometry; infrared studies of the atmosphere; laser and remote sensing techniques for atmospheric sounding; light scattering; and imaging systems and instrumentation were discussed. For individual titles, see N86-22028 through N86-22041.

N86-22028# Tromsoe Univ. (Norway). Auroral Observatory.
SPECTROSCOPIC OBSERVATIONS OF THE AURORA AND NIGHTGLOW AT SVALBARD
K. Henriksen, K. Stamnes, and G. Witt (Stockholm Univ.) *In* Stockholm Univ. Proceedings of the 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 4-14 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

It is shown that the NII 5001/5 multiplet is a dominating spectral feature in the nightside aurora on the latitude of the polar cleft, whereas the NI 5199/5201 doublet is strongest on the dayside. The NII 5001/5 emissions are primarily caused by harder electron precipitation than the NI 5199/5201 doublet. In the infrared, the NI 8446 line is a good indication of auroral activity. At 8521A an emission correlated with auroral activity appears, it is most likely due to the Q23 band head of the N2 1P(3,2) vibrational band. Even if argon has an intense emission at 8521A, the possibility of a significant contribution from argon is low. Author (ESA)

N86-22029*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Dept. of Physics and Astronomy.
OBSERVATIONS OF BARIUM ION JETS IN THE MAGNETOSPHERE USING DOPPLER IMAGING SYSTEMS AND VERY SENSITIVE IMAGING SYSTEMS USING IMAGING PHOTON DETECTORS
D. Rees, J. Conboy, W. Heinz, and J. P. Heppner *In* Stockholm

Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 15-38 refs Prepared in cooperation with University College, London, England (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

Observations of four shaped charge releases from rockets launched from Alaska are described. Results demonstrate that imaging and Doppler imaging instruments, based on exploiting the imaging photon detector, provide additional insight into the motion and development of low intensity targets such as the fast ion jets produced by shaped charge releases. It is possible to trace the motion of fast ion jets to very great distances, of the order of 50,000 km, outward along the Earth's magnetic field, when the conditions are suitable for the outward (upward) motion and/or acceleration of such ion jets. It is shown that ion jets, which fade below the lower sensitivity threshold of previous instruments, do not always disappear. There is no evidence of an abrupt field-aligned shear-type acceleration. Author (ESA)

N86-22030# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OBSERVATIONS OF AIRGLOW O2 (1 SIGMA) ATMOSPHERIC BAND AT 8645A AND THE ROTATIONAL TEMPERATURE AT 23 S
H. Takahashi, Y. Sahai, and P. P. Batista *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 39-50 refs (For primary document see N86-22027 12-46)
(Contract FINEP-537/CT)
Avail: NTIS HC A12/MF A01

Observations of the O2 (1 Sigma, 0-1) atmospheric band at 8645A (O2A) and the rotational temperature, with the OH(9,4) band and OI 5577A airglow emissions, using multichannel tilting filter type photometers, were carried out at Cachoeira Paulista (22.7 S, 45.0 W) Brazil. The O2A band intensities occasionally vary from 200 to 1000 Rayleighs during a night. Covariations in nocturnal and seasonal variation with the OI 5577A emissions are observed. The rotational temperatures determined from the P branch of the O2 (1 Sigma) vary between 180 and 230 K. The amplitude of the nocturnal temperature variation is frequently larger than that determined from the OH emission, and the phase of the variation can lead that of the OH. Author (ESA)

N86-22031# Queens Univ., Belfast (Northern Ireland). Dept. of Pure and Applied Physics.
THE NIGHTGLOW HYDROXL (8-3) BAND EMISSION: A COMPARISON OF EXPERIMENT AND THEORY
D. P. Murtagh and R. G. H. Greer *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 51-69 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

The results of a rocket measurement of the hydroxyl (8-3) band volume emission profile are presented. Near simultaneous determinations of atomic oxygen concentrations allow the computation of mesospheric ozone densities in a chemistry based model. Using the hydrogen-ozone mechanism, it is found that the observed intensity is consistent with a model in which vibrational relaxation plays an important role. The theoretical profile is in reasonable agreement with the observations, but the problems associated with hydroxyl emission models are considered. Author (ESA)

N86-22032# Physical Sciences, Inc., Andover, Mass.
KINETICS AND SPECTROSCOPY OF HIGH ALTITUDE INFRARED EMISSIONS
Wilson T. Rawlins *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 70-92 refs Sponsored in part by DNA and AF (For primary document see N86-22027 12-46)
(PSI-G050-SR-207) Avail: NTIS HC A12/MF A01

The study of infrared phenomenology at high altitudes (70 to 150 km) is introduced. Relationships between observed molecular infrared signatures and the chemical dynamics of the quiescent and auroral upper atmosphere are emphasized. Laboratory and in situ measurement programs are described. The coupling of laboratory and field data with kinetic modeling to characterize specific excitation mechanisms for vibrationally excited NO, O3, and CO2 is illustrated. Author (ESA)

N86-22033# Wuppertal Univ. (West Germany).
MIDDLE INFRARED EMISSION STUDIES IN THE UPPER ATMOSPHERE BY ROCKET TECHNIQUES
K. U. Grossmann *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 93-113 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

A liquid helium cooled infrared twin grating spectrometer for use on sounding rockets was built. It was successfully flown three times on Skylark rockets from Esrange, Sweden. The experiments covered the midinfrared spectral range of 2.5 to 17 microns with a resolving power of 150 during the first two flights and 85 during the last flight. The far infrared regime between 50 and 100 microns was scanned with a resolution of 15. The instruments yielded zenith spectra and zenith intensity profiles of the vibration-rotation band emissions of CO2 at 15 microns and of O3 at 9.6 microns. In the far infrared the pure rotational spectrum of water vapor was measured. Author (ESA)

N86-22034# Nice Univ. (France). Dept. d'Astrophysique.
SCINTILLATION DETECTING AND RANGING (SCIDAR/LIDAR) DESCRIPTION OF A GRAVITY WAVE AND ASSOCIATED TURBULENCE
Jean Vernin *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 114-121 (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

The SCIntillation Detection And Ranging (scidar) optical device was used for remote sensing of atmospheric turbulence from an altitude of 1 km up to 20 to 30 km. The basic principle of this turbulence profiler is the statistical analysis of the speckle pattern produced by the light coming from a double star. It detected a thin sheet structure inside a thick turbulent layer at the tropopause. The periodic occurrence of turbulence in respect to time and altitude was associated with a gravity wave degenerating in turbulence. Its vertical wavelength is found to be 2700 m, and its apparent temporal periodicity 38 min. Two infinity sets of solutions describe the two components of the horizontal wavenumber, and temporal frequency of the gravity wave. Lidar ozone measurements show the same temporal periodicity, with wavelength 21.3 km. Author (ESA)

N86-22035# Tromsoe Univ. (Norway). Auroral Observatory.
MULTIPLE SCATTERING AND RADIATIVE TRANSFER IN PLANETARY ATMOSPHERES
Knut Stamnes *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 122-163 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

Multiple scattering theory associated with radiative transfer problems in planetary atmospheres is reviewed. The radiative transfer equation pertaining to a scattering, absorbing, and emitting medium is considered. Analytic solutions and computational aspects for plane parallel atmospheres are discussed. These computationally efficient and reliable solutions can be used to attack a multitude of radiative transfer problems in realistic atmospheres. Applications to auroras are considered.
Author (ESA)

N86-22036# Oxford Univ. (England). Physical Chemical Lab.
ATOM RECOMBINATION AS A SOURCE OF AIRGLOW
R. P. Wayne *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 164-179 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

The basic principles of atom recombination are considered, and simple arguments that yield rough estimates of the rate coefficients for different recombination mechanisms are presented. More sophisticated methods for the calculation of recombination rate parameters are outlined to provide a context for the interpretation of theories. Factors that might determine the distribution of recombination events into the available electronic states are discussed. Author (ESA)

N86-22037# Research Inst. for Physics, Stockholm (Sweden).
EXPERIMENTAL AND THEORETICAL INFORMATION ON RADIATIVE LIFETIMES AND OSCILLATOR STRENGTHS
Mats Larsson *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 180-187 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

Diagnostic studies of the upper atmosphere by using the methods of quantitative spectroscopy on auroral and airglow emissions are reviewed. Data on oscillator strengths, transition probabilities and radiative lifetimes for atoms and molecules are discussed. Formulas for converting between the different types of dynamical parameters, such as oscillator strength, and transition probability for atoms are outlined. The situation for molecules is considered. Author (ESA)

N86-22038# Maryland Univ., College Park. Inst. of Molecular Physics.
EVOLUTION OF N2 EXCITED STATE VIBRATIONAL LEVEL POPULATIONS FOLLOWING DIRECT ELECTRON EXCITATION
William Benesch *In* Stockholm Univ. Proceedings of 12th Ann. Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 188-199 (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

Experiments to elucidate the processes governing the population distribution among the molecular nitrogen triplet state vibrational levels, under circumstances where molecular collisions are important, were conducted in conditions analogous to those in low altitude auroras. Nitrogen gas, at 0.03 to 3.0 Torr was excited by a pulsed electric discharge. The radiation was detected with a photomultiplier tube. The electrical signal was amplified and fed into a boxcar integrator to select a specific time interval after the exciting pulse for spectrometric display on a stripchart recorder. It is possible to follow the history of the excited molecules well into the afterglow. Using time resolutions down to the microsecond level and pressures < 0.1 Torr, characteristics of the spectrum on a collision-by-collision basis can be recorded. The time-development of well known auroral species is discussed.
Author (ESA)

N86-22039# University Coll., London (England). Dept. of Physics and Astronomy.
INITIAL SIMULATIONS OF THE HIGH LATITUDE THERMOSPHERE AND IONOSPHERE WITH A COUPLED THREE DIMENSIONAL MODEL
David Rees, S. Quegan (Marconi Space Systems, Chelmsford, England), R. Moffett (Sheffield Univ., England), I. Perla, R. Gordon, and T. J. Fuller-Rowell *In* Stockholm Univ. Proceedings of 12th Ann. Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 200-225 refs Sponsored in part by UK Science and Engineering Research Council (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

A joint three dimensional time-dependent global model of the Earth's thermosphere and ionosphere which includes self-consistent coupling between the thermosphere and the ionosphere in the polar regions was developed. Features in the polar ionosphere which the simulations indicate are due to the strong coupling of ions and neutrals in the presence of strong electric fields and energetic electron precipitation are reviewed. The model also simulates UT variations in the polar thermosphere and ionospheric regions due to the diurnally variable solar photoionization in specific geomagnetic regions such as the cusp and polar cap. Author (ESA)

N86-22040# Kiruna Geophysical Inst. (Sweden).
AN INTENSIFIED PHOTODIODE ARRAY APPLIED TO ONE-DIMENSIONAL AURORAL IMAGING
Aake Steen *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 226-245 refs (For primary document see N86-22027 12-46)
(Grant AF-AFOSR-0084-84)
Avail: NTIS HC A12/MF A01

An imaging instrument than can replace mechanically scanning photometers in ground based auroral photometry was developed. The instrument utilizes a Reticon photodiode array, 1*1024 pixels, coupled with fiber optics to an image intensifier. The optics is a telecentric design allowing for 170 deg FoV with narrow band interference filters. Peltier element cooling is found to be sufficient to neglect dark current noise for 1 sec integration time. The whole system is controlled by a computer via the IEEE-488 bus. Test results and instrument performance are encouraging. Author (ESA)

N86-22041# University Coll., London (England). Dept. of Physics.
OBSERVATIONS OF AURORAL AND AIRGLOW SPECTRA USING A GRATING SPECTROMETER WITH AN IMAGING PHOTON DETECTOR
D. Rees, J. Conboy, W. Heinz, G. Witt (Stockholm Univ.), and J. Stegman (Stockholm Univ.) *In* Stockholm Univ. Proceedings of 12th Annual Meeting on Atmospheric Studies by Optical Methods 15 Aug. 1985 p 246-264 refs (For primary document see N86-22027 12-46)
Avail: NTIS HC A12/MF A01

A grating spectrometer of 60 cm focal length and 15 cm grating width was equipped with an imaging photon detector to observe the night sky spectra. Data include a sequence of complete spectra of the night sky from 350 to 700 nm. Most of the line and band spectra associated with airglow and auroral emissions within this spectral region are positively identified. With an integration period of 120 sec, it is possible to observe the scattered Fraunhofer spectrum of sunlight in the visible-light spectral region, even during periods near midnight in winter. An attempt to detect the O2 Hertzberg or Chamberlain bands was unsuccessful, with the competition from the strong Fraunhofer absorption lines in this region being partly responsible. Author (ESA)

N86-22042# McMillian Science Associates, Inc., Los Angeles, Calif.
EARTHQUAKE LIGHT Final Report, 1 Mar. 1983 - 15 Aug. 1986
W. G. McMillan 15 Aug. 1985 65 p
(Contract F0462-83-C-0079; ARPA Order 4700)
(AD-A161385; MSA-FCR-36; AFOSR-85-0923TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

This paper focuses on manifestations of earthquake light that appear to be of electromagnetic origin: general atmospheric luminosity; light flashes; and auroral effects. Explanations of near-ground phenomena are offered in terms of acceleration of free electrons in air by a geoelectric field, both electron number density and field possibly being enhanced by the earthquake. High-altitude phenomena resemble natural aurorae, but apparently utilize electrons stored in the natural reservoirs of the ionosphere (F layer) and Van Allen belt. Various mechanisms for accelerating ionospheric electrons and for lowering the mirror-point altitudes of Van Allen electrons are examined. Author (GRA)

N86-22043# Birmingham Univ. (England). Dept. of Space Research.
ION AND ELECTRON INTERACTIONS OF ATMOSPHERIC IMPORTANCE
David Smith and Nigel G. Adams 31 Aug. 1985 100 p
(Grant AF-AFOSR-0095-82)

(AD-A161619; AFGL-TR-85-0247; SR-3) Avail: NTIS HC A05/MF A01 CSCL 04/1

Exploited are variable-temperature selected ion flow tube (VT-SIFT), variable-temperature selected ion flow drift tube (VT-SIFDT) and variable-temperature flowing afterglow/Langmuir probe (VT-FALP) apparatuses to study: (1) Ion/neutral reactions at thermal energies (VT/SIFT), (2) ion-neutral reactions as a function of the center-of-mass energy of the reactants (VT-SIFDT), (3) electron attachment at thermal energies (VT-FALP), and (4) electron/ion dissociative recombination (VT-FALP). Under 1 and 2, new kinetic and thermochemical data have been obtained and under 3 new data include attachment coefficients for strong acids. GRA

N86-22044# American Chemical Society, Springfield, Va. Div. of Industrial and Engineering Chemistry.

ULTRASONIC MODEL INVESTIGATION OF THE EFFECTS OF LATERAL HETEROGENEITIES ON SEISMIC SURFACE WAVE PROPAGATION AND SCATTERING Final Report, 1 Aug. 1981 - 31 May 1984

M. N. Toksoez 10 Sep. 1985 71 p Original contains color illustrations

(Contract DAAG29-81-K-0145)

(AD-A161720; ARO-18022.3-GS) Avail: NTIS HC A04/MF A01 CSCL 08/11

The effects of topographic features on Rayleigh wave propagation and scattering are investigated using two and three-dimensional ultrasonic models. Starting from simple steps, different topographic features are modeled. The effects of these features on Rayleigh wave transmission and scattering are examined as a function of wavelength. In general, backscattered or reflected of the Rayleigh wave energy is scattered into body waves. To complement the laboratory studies, two-dimensional finite difference calculations are carried out. These show the details of the scattering of incident Rayleigh waves at a step discontinuity into P, S and Rayleigh waves. More energy scatters into S waves than into P waves. Using three-dimensional laboratory models of steps, the dependence of wave scattering on angle of incidence is studied. Transmission and reflection coefficients (transmitted or reflected energy/incident energy) computed from spectral ratios vary strongly with incident energy) computed from spectral ratios vary strongly with incidence angle. At wavelengths equal to twice the step height, the fraction of incident energy scattered into body waves ranges from more than 90% at normal incidence to about zero at near-grazing incidence. At each angle, transmission coefficients vary strongly with frequency. Because of frequency-dependent phase shifts, the transmitted and reflected waves are distorted. GRA

N86-22045# Naval Research Lab., Washington, D. C.

CHAOS AND NONLINEAR DYNAMICS OF SINGLE-PARTICLE ORBITS IN A MAGNETOTAIL-LIKE MAGNETIC FIELD

J. Chen and P. J. Palmadesso 22 Nov. 1985 29 p

(AD-A161750; NRL-MR-5665) Avail: NTIS HC A03/MF A01 CSCL 04/1

The properties of charged-particle motion in Hamiltonian dynamics are studied in a magnetotail-like magnetic field configuration. It is shown by numerical integration of the equation of motion that the system is generally nonintegrable and that the particle motion can be classified into three distinct types of orbits; the bounded integrable orbits, unbounded stochastic orbits and unbounded transient orbits. It is also shown that different regions of the phase space exhibit qualitatively different response to external influences. The concept of differential memory in single-particle distributions is proposed. Physical implications to the dynamical properties of the magnetotail plasmas, and the possible generation of non-Maxwellian features in the distribution function are discussed. GRA

N86-22046# Calspan Corp., Buffalo, N. Y.

A CHAMBER INVESTIGATION OF THE IR AND VISIBLE WAVELENGTH OBSCURATION PROPERTIES OF PYROTECHNICALLY GENERATED SMOKES

J. T. Hanley and E. J. Mack May 1985 49 p

(Contract N00014-84-C-2174)

(AD-A161753; CALSPAN-7278-1) Avail: NTIS HC A03/MF A01 CSCL 19/1

The overall objective of the program is the development of an effective screening agent to both visible and IR wavelengths utilizing pyrotechnically-generated hygroscopic aerosol. In pursuit of an effective IR wavelength screen and an increased understanding of the particle formation mechanisms and resultant size distribution, the primary objective of this year's effort was to evaluate the influence of an energetic binder (GAP) on the performance of two pyrotechnics, one which produced a KCL aerosol, the other a mixed aerosol, the other a mixed aerosol of MgCl2 and carbon. Comparison tests were run, in Calspan's 600 cu m test chamber, in which the performance of the energetic vs. non-energetic pyrotechnics was compared in terms of mass yield, payload mass extinction coefficient, aerosol decay rate and size distribution. A secondary objective of limited scope was to investigate the potential of using IR absorbing surface active agents to coat the smoke aerosol so as to enhance the smoke's IR wavelength absorption as well as inhibit subsequent aerosol evaporation upon exposure to decreasing humidity. GRA

N86-22047# Columbia Univ., New York.

GROUND RESPONSE IN ALLUVIAL BASINS DUE TO SEISMIC DISTURBANCES Final Report, Mar. 1981 - Sep. 1984

John T. Kuo and Yu-Chiung Teng Mar. 1985 171 p

(Contract F19628-81-K-0012)

(AD-A162467; AFGL-TR-85-0062) Avail: NTIS HC A08/MF A01 CSCL 08/11

This report summarizes the scientific accomplishments of this contract. These include: (1) five preliminary basin models for SH-waves and three for elastic (P and SV) waves were studied using the finite element method, the results of these problems are presented either by synthetic seismograms or by snapshots; (2) modification and improvement of the two dimensional finite element computer codes with particular attention being paid to save computer in-core storage and computing time; (3) development of a new finite element technique to simulate different types of seismic sources, an example of demonstrating the difference in waveforms due to different types of source is appended; and (4) a detailed description and user's guide for the two-dimensional elastodynamic finite element computer program developed at Aldridge and adapted to the VAX 11 computer at AFGL is provided. GRA

N86-22048# Air Force Geophysics Lab., Hanscom AFB, Mass.

A GLOBAL REFERENCE ATMOSPHERE FROM 18 TO 80 km, AIR FORCE SURVEYS IN GEOPHYSICS

Gerald V. Groves 31 May 1985 126 p

(AD-A162499; AFGL-TR-85-0129; AFGL-AFSG-448) Avail: NTIS HC A07/MF A01 CSCL 04/2

Monthly means of zonal mean temperature, pressure, density, number density, pressure scale height, and geostrophic W-E wind are tabulated at heights from 18 to 80 km and latitudes from 80 S to 80 N with a 10 deg latitude interval. Formulae by which these quantities may be computed are present. Monthly mean longitudinal variations of temperature, pressure and density are tabulated at 30 deg longitude intervals for September to April in the N Hemisphere and April to November in the S Hemisphere at latitudes 20, 30, ..., 80 N (or S) over the same range of heights. Formulae by which the temperature, pressure and density variations may be computed are presented. The zonal means are derived from tabulations of temperature and geopotential height based on Nimbus 5 SCR and Nimbus 6 PMR and a S Hemisphere reference atmosphere based on rocketsonde data that were both prepared for the COSPAR Meeting, Graz 1984 and on two earlier N hemisphere rocket-based reference atmospheres. CIRA 1972 and Air Force Reference Atmospheres (1978). The longitudinal variations are derived solely from the satellite-based tabulations. Comparisons are made between the rocket-based reference atmospheres, the satellite-based tabulations and the reference values presented here. Author (GRA)

N86-22049# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

X-RAY MICROBURSTS AND VLF CHORUS

J. L. Roeder, J. R. Benbrook, E. A. Bering, W. R. Sheldon, and E. G. Stansberry 30 Sep. 1985 29 p Prepared in cooperation with Houston Univ., Tex.

(Contract F04701-83-C-0084)

(AD-A162531; TR-0084A(5940-06)-4; SD-TR-85-71) Avail: NTIS HC A03/MF A01 CSCL 03/2

On January 4, 1978, at 1140 UT, a Super Arcas sounding rocket was launched from Siple Station, Antarctica (L = 4.2, 76 S, 84 W) during a geomagnetically disturbed period (K sub p = 6-) with intense X-ray and VLF chorus activity. The parachuted payload observed an intense microburst precipitation event of 10 minute duration. These data have been correlated with measurements of Very Low Frequency chorus by receivers on the ground at both Siple and its magnetic conjugate point, Roberval, Quebec. Detailed one-to-one correspondence between the microbursts and the chorus was not a consistent feature of the data. Time series analysis of the data did indicate a significant correlation between the Siple X-ray precipitation and the Roberval VLF waves with an arrival time delay of 0.1 + or - 0. GRA

N86-22050# Air Force Geophysics Lab., Hanscom AFB, Mass.

SPECTROSCOPIC, KINETIC, AND DYNAMIC EXPERIMENTS ON ATMOSPHERIC SPECIES Final Report, 1 Oct. 1982 - 30 Sep. 1984

S. M. Miller, J. B. Lurie, R. A. Armstrong, I. Winkler, and J. I. Steinfeld 21 Mar. 1985 252 p

(AD-A162691; AFGL-TR-85-0077; AFGL-PSRP-668) Avail: NTIS HC A12/MF A01 CSCL 04/1

This final report on atmospheric species experiments contains: the results of COCHISE (Cold Chemical Infrared Simulation Experiment) experiments involving the interaction of N2 with CO, O3(v) with N2 and the fluorescences of NO and N2; a theoretical discussion of O2/Ar and N2/Ar microwave discharges; trajectory calculations involving the collisional relaxation of high vibrational-rotational states of O3 by Ar; the experimental determination of the intramolecular branching ratio of the (021) and (101) combination bands of CO2; a determination of the distribution of vibration sites of NO(v) from the reaction N(4S) + O2 yield NO(v) via multiphoton ionization; (flowing atmospheric kinetic infrared experiment (FAKIR) measurements of atomic oxygen production in the reaction between N(2D) and CO2 and the quenching of N(2D) by atomic oxygen; both the visible and infrared fluorescence results from the Laser Infrared Nuclear Simulation (LINUS) project. GRA

N86-22051# Johns Hopkins Univ., Laurel, Md. Dept. of Space.

HIGH FREQUENCY RADAR STUDIES OF THE VERY HIGH LATITUDE IONOSPHERE Final Report, 15 Feb. 1983 - 30 Sep. 1985

Raymond A. Greenwald 30 Sep. 1985 57 p

(Grants AF-AFOSR-ISSA-85-00084; AF-AFOSR-ISSA-84-00042)

(AD-A162754; AFOSR-85-1200TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

Operation of the Goose Bay radar began on October 11, 1983. Since that time collaborative measurements have been made with both the Sondre Stromfjord and Millstone Hill incoherent scatter radars, with the HILAT satellite, and with the Air Force Geophysics Laboratory Airborne Geophysical Observatory. In addition, an extensive set of noncollaborative measurements have been obtained. From this base of observation several papers have been written and submitted for publication and several studies have been initiated but not, as yet, reached the publication stage. These efforts include an examination of high latitude F-region irregularties in the afternoon and late evening local time sectors, an attempt to use the HF radar data to study the two-dimensional structure of irregularity drifts, a detailed study of plasma conditions and irregularity characteristics in the vicinity of the dayside cleft, attempts to compare E- and F-region irregularity drifts with plasma drift measurements obtained with the Sondre Stromfjord and Millstone Hill incoherent scatter radars, and some preliminary observations of seasonal depencences in the diurnal formation of high latitude F-region irregularities. GRA

N86-22052# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.

MEASUREMENT OF HORIZONTAL STRUCTURES AND WAVELENGTHS (5-500 km) IN MESOSPHERIC GRAVITY WAVES, TIDES AND WINDS. WORKSHOP AND DESIGN STUDY Final Report, 15 May - 14 Nov. 1984

Gene W. Adams 30 Aug. 1985 14 p

(Grant AF-AFOSR-0121-84)

(AD-A162768; AFOSR-85-0996TR) Avail: NTIS HC A02/MF A01 CSCL 17/9

It is well known that monostatic radars are poor meteor-wind radars. It has been suggested, however, that an outboard receiving site, configured as an interferometer, could receive pulses scattered by meteor trails from the ST's beams, resolve the geometry, and thus measure winds in the 80 to 110 km region. This approach, dubbed MENTOR (Meteor Echoes; No Transmitter, Only Receivers), would be an inexpensive way to add mesospheric capabilities to ST radars. The cost of a MENTOR receiver system is expected to be a small fraction of the cost of either a meteor-wind system or an ST radar. In addition, locations such as Colorado and Pennsylvania that have networks of ST radars could use a single MENTOR receiving site to determine winds above all ST radars within a several hundred kilometer radius. This could make possible the measurement of gravity-wave phenomena over much larger horizontal distances than can be accomplished from a single site. The MENTOR approach in Colorado (or anyplace else with a network of MST radars) should yield important new information about winds in the mesosphere and about mesospheric gravity waves with horizontal scales of 50 to 500 km. Author (GRA)

N86-22053# Lawrence Livermore National Lab., Calif.

REAL-TIME MONITORING OF PRE-COLLAPSE PHENOMENA USING LOCATIONS OF SEISMIC SOURCES

S. P. Jarpe and N. R. Burkhard Sep. 1985 13 p refs Presented at the 3rd Symposium on Containment of Underground Nuclear Explosions, Idaho Falls, Ida., 10 Sep. 1985

(Contract W-7405-eng-48)

(DE86-001649; UCRL-93326; CONF-850953-11) Avail: NTIS HC A02/MF A01

We attempted to develop a method for real-time monitoring of pre-collapse activity in the cavity region using seismic trace data recorded following EGMONT. Signals from an array of eight three-component, short-period seismometer stations were recorded using a new high dynamic range, portable digital telemetry and recording system. Three stations were located at 1 DOB, three at 2 DOB, and two at 4 DOB. Seismic data were recorded continuously before, during, and after collapse. As has been reported by previous studies, the pre-collapse period was characterized by a continuous high level of activity, but unlike previous studies, the recording system was not saturated, which allowed us to attempt to process the information. We discovered that all of the signals at a given location are very similar, but that the character is very different at the separate locations. A variety of computer processing techniques were attempted with the aim of obtaining source locations accurately enough to monitor chimney growth, i.e., +-50m both horizontally and vertically. These included the traditional methods of picking arrival times of phases at the different stations and using the time differences to locate the source, as well as more unusual approaches. We concluded that an array of sensors such as that used for EGMONT will not produce satisfactory results with real-time processing. We did, however, come up with an approach using several small, closely-spaced groups of sensors called arrays that should be more successful for this type of situation. The arrays, if designed properly, will take advantage of the similarity of the signals at a given location to estimate source direction. The directions from several arrays to one source can be combined to determine the source location. DOE

N86-22054# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.

NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) METEOROLOGY DIVISION SUPPORT TO THE ENVIRONMENTAL PROTECTION AGENCY Summary Report, Fiscal Year 1984

J. H. Viebrock Jul. 1985 70 p Sponsored in part by Environmental Protection Agency, Washington, D.C.

(PB86-101664; NOAA-TM-ERL-ARL-139) Avail: NTIS HC A04/MF A01 CSCL 04A

The Meteorology Division provided research and meteorological support to the Environmental Protection Agency. The primary research effort was the development and evaluation of air quality simulation models using numerical and physical techniques supported by field studies. Activity highlights included the initial implementation of the first generation Regional Oxidant Model; development of a Photochemical Box Model for use in screening high level O3 episodes during stagnant conditions in urban areas; description of a model for the diurnal behavior of the layer of surface-based turbulent mixing and the wind and temperatures averaged over this layer; conduct of a major complex terrain field study at the Tracy Power Plant near Reno, Nevada; and preparation of a scientific assessment document on the status of complex terrain dispersion models. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-22055 State Univ. of New York, Albany.

INTERACTIONS BETWEEN UNSTABLE BAROCLINIC AND RESONANT, TOPOGRAPHIC WAVES IN A TWO-LAYER MODEL OF THE ATMOSPHERE Ph.D. Thesis

Terrence Ronald Nathan 1985 149 p

Avail: Univ. Microfilms Order No. DA8523308

Interactions between unstable baroclinic and resonant, topographic waves are investigated in a quasi-geostrophic two-layer model on the Beta-plane with sinusoidal topography and dissipation. The dissipative processes are of two types: Asymmetric Ekman dissipation, and internal dissipation due to interfacial friction and equivalent thermal damping. The weakly nonlinear analysis requires two long time scales to describe the evolution of the baroclinic wave while the topographic wave evolves only on the longest time scale. This is due to the fact that the linear growth rate of the baroclinic wave, which is modified by the topography, is larger than the linear growth rate of the topographic wave. To facilitate the analysis, the method of reconstitution is used to form evolution equations on a combined time scale. If both Ekman dissipation and internal dissipation are considered, the interaction dynamics of the baroclinic and topographic waves are characterized by either periodic vacillations or damped vacillatory approaches to equilibration. Dissert. Abstr.

N86-22056*# Universities Space Research Association, Columbia, Md.

SOLITON TURBULENCE Quarterly Contractor Report, 30 May - 20 Nov. 1985

C. M. Tchen Washington NASA Mar. 1986 75 p refs

(Contract NAS8-36153)

(NASA-CR-3969; NAS 1.26:3969) Avail: NTIS HC A04/MF A01 CSCL 04B

Theoretical and numerical works in atmospheric turbulence have used the Navier-Stokes fluid equations exclusively for describing large-scale motions. Controversy over the existence of an average temperature gradient for the very large eddies in the atmosphere suggested that a new theoretical basis for describing large-scale turbulence was necessary. A new soliton formalism as a fluid analogue that generalizes the Schrodinger equation and the Zakharov equations has been developed. This formalism, processing all the nonlinearities including those from modulation provided by the density fluctuations and from convection due to the emission of finite sound waves by velocity fluctuations, treats large-scale turbulence as coalescing and colliding solitons. The new soliton system describes large-scale instabilities more explicitly than the Navier-Stokes system because it has a nonlinearity of the gradient type, while the Navier-Stokes has a nonlinearity of the non-gradient type. The forced Schrodinger equation for strong fluctuations describes the micro-hydrodynamical state of soliton turbulence and is valid for large-scale turbulence in fluids and plasmas where internal waves can interact with velocity fluctuations. Author

N86-22057# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

PERIODICITIES IN THE ALL INDIA RAINFALL SERIES AND IN THE DROUGHT AND FLOOD AREA INDICES

R. P. Kane Nov. 1985 39 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication

(INPE-3717-PRE/853) Avail: NTIS HC A03/MF A01

Using the method of Maximum Entropy Spectral Analysis (MESA) for locating periodicities and a Multiple Regression Analysis for amplitude estimations, the All-India annual, summer and nonsummer rainfall and the Drought and Flood Area Indices were analyzed. Significant periodicities were observed in a wide band; but, in each case, substantial Quasi-Biennial Oscillations (QBO) were noticed, which made predictions impossible. Author

N86-22058# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A MERIDIONAL CIRCULATION MODEL TO STUDY UPPER ATMOSPHERE SEASONAL PHENOMENA

Carlos Jose Zamlutti Nov. 1985 53 p refs Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication

(INPE-2716-PRE/852) Avail: NTIS HC A04/MF A01

This paper presents a meridional circulation model for the study of the upper atmosphere dynamics at middle latitudes. In the study of the energy balance, it considers two geomagnetic conjugated locations, connected to each other through plasma flow, along the magnetic field lines, and linked, at mesopause altitudes, by meridionally propagating gravity waves. It is shown that the closed loop is necessary to account for the energy transferred from the ions to the neutrals. Author

N86-22059# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

LARGE SCALE PRECIPITATION VARIATIONS OVER SOUTH AMERICA DURING THE 1982-83 ENSO EVENT

Antonio Divino Moura and Mary Toshie Kagano Oct. 1985 10 p refs Presented at the 1st WMO Workshop on the Diagnosis and Prediction of Monthly and Seasonal Atmospheric Variations over the Globe, College Park, Md., 29-Jul. - 2 Aug.

(INPE-3676-PRE/827) Avail: NTIS HC A02/MF A01

The effects of 1982-83 ENSO EVENT over South America are reanalyzed mainly with respect to large-scale precipitation anomalies. Long lasting and very intense floods have occurred in the southern part of Brazil, northern Argentina, Paraguay, Uruguay, Southern Bolivia, mainly during the period May to July 1983. Also, severe droughts have striken Northeast Brazil, including the Amazon region which was very dry during 1983. Ecuador and northwestern Peru suffered strong flood conditions from the end of 1982 until mid-1983. Some GCM simulations reproduced the general aspects of the atmospheric circulation observed during last strong warming over Eastern Pacific. Theoretical results suggest that the precipitation anomalies observed over South America could be explained as the atmospheric response to the anomalous heating over the Eastern Pacific associated with the El Nino. Author

N86-22060# Hydrologic Engineering Center, Davis, Calif.

STOCHASTIC ANALYSIS OF DROUGHT PHENOMENA Final Report

David Goldman Jul. 1985 141 p

(AD-A160947; HEC-TD-25) Avail: NTIS HC A07/MF A01 CSCL 12/1

Droughts are caused by both hydrologic and socioeconomic components. This document concentrates on stochastic models of streamflow as the hydrologic component of drought. Stochastic models of drought are presented to the water resource engineer as an extension of the more commonly understood flood frequency analysis. The extension can be made because flood frequency analysis utilizes stochastic models of independent random variables whereas drought analysis utilizes stochastic models of independent random variables. There are many different stochastic models that have been implemented to describe dependent random variables. A comparison of these models indicate that simple ones, such as the autoregressive model, are adequate for the water resource engineer's needs. Author (GRA)

N86-22061# Massachusetts Inst. of Tech., Lexington.
WEATHER RADAR STUDIES Quarterly Technical Summary Report, 1 Jan. - 31 Mar. 1985
James E. Evans 31 Mar. 1985 42 p
(Contract DT-FA01-80-Y-10546)
(AD-A161622; DOT/FAA/PM-85-16) Avail: NTIS HC A03/MF A01 CSCL 04/2

FAA-funded Doppler weather radar activities during the period 1 January to 31 March 1985 are reported. The test-bed Doppler weather radar system measurements in Olive Branch, Mississippi, commenced following the installation of an improved lightning protection system. Clutter suppression testing showed that the objective of 50-dB suppression was obtained in the field against appropriate fixed targets. Weather measurements were conducted on a number of cold front passages with attendant prefrontal lines of showers and thunderstorms. The Lincoln mesonet was recalibrated at Lincoln in January and February and then installed at the site in late February. The mesonet was fully operational in March. The 1984 peak wind speed data from the mesonet and the Memphis International Airport LLWAS data were analyzed preliminarily to determine wind shear characteristics in the Memphis area. Doppler weather radar data from the National Center for Atmospheric Research JAWS program and the National Severe Storms Laboratory are being analyzed to develop low-altitude wind shear detection algorithms. GRA

N86-22062# Lamont-Doherty Geological Observatory, Palisades, N. Y.
AIR MASS MODIFICATION IN THE MARGINAL ICE ZONE Final Technical Report
Theodore J. Bennett, Jr. and Kenneth Hunkins Nov. 1985 38 p
(Contract N00014-84-K-0735)
(AD-A161745; LDGO-85-6) Avail: NTIS HC A03/MF A01 CSCL 04/1

A case study of the Andreas, et al., (1984) data on atmospheric boundary layer modification in the marginal ice zone is made. Our model is a two-dimensional, multi-level, linear model with turbulence, lateral and vertical advection, and radiation. Good agreement between observed and modeled temperature cross-sections is obtained. In contrast to the hypothesis of Andreas, et al., we find the air flow is stable to secondary circulations. Cloud top longwave cooling, not an air-to-surface heat flux, dominates the cooling of the boundary layer. The accumulation with fetch over the ice of changes in the surface wind field are shown to have a large effect on estimates of the surface wind stress. We speculate that the Andreas, et al., estimates of the drag coefficient over the compact sea ice are too high. GRA

N86-22063# Naval Postgraduate School, Monterey, Calif.
AIR PARCEL MOTION AT THE VANDENBERG HYDROGEN FLARE STACKS Report, Dec. 1984 - Oct. 1985
Gordon E. Schacher and Charles E. Skupniewicz Oct. 1985 118 p
(Contract MIPR-FY6168500914)
(AD-A162520; NPS61-86-005) Avail: NTIS HC A06/MF A01 CSCL 19/1

Three months of flow and turbulence data obtained at the Vandenberg AFB hydrogen flare stack site has been used to simulate the behavior of the plume. Time series analyses have been used to determine air parcel trajectories. Turbulence in the area is sufficient to carry air parcels to ground level. The spatial persistence of the trajectory end and function of time spent near the average position have been determined as functions of conditions. The results have been prepared and methodologies outlined to enable heat deposition calculation to be performed. GRA

N86-22064# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Wolkenphysik.
THE ICING RESEARCH AIRCRAFT DO28, D-IFMP OF DFVLR, AND ITS MEASURING EQUIPMENT
Hans-Eberhard Hoffmann and Johann Demmel Aug. 1985 72 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-972)
(DFVLR-Mitt-85-12; ISSN-0176-7739) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 25.50

A Dornier Do28 D-IFMP, equipped as an icing research aircraft, is described. Ice accretion is measured on three metal cylinders and at the tip of one wing. The icing-relevant, cloud-physical parameters measured include air temperature, liquid water content, particle size (0.5 to 600 micron), particle concentration, particle phase (qualitative), visibility in and outside clouds, relative humidity, and absolute humidity. The measured data are recorded on two analog and one digital recorder. Author (ESA)

N86-22065# National Weather Service, Silver Spring, Md. Engineering Div.
MAINTENANCE PLANNING FOR THE 1990'S (INITIAL PLANNING)
W. J. VanFeldt, R. R. Knibb, D. M. Entrikin, A. Kerner, and R. I. Racer Jul. 1985 51 p refs
(PB86-106010; NOAA-TM-NWS-ENG-11) Avail: NTIS HC A04/MF A01 CSCL 04B

New equipment programs, changing technologies, staffing constraints, and restrictive budgets are but a few of the reasons why the National Weather Service (NWS) must strive for greater efficiency and productivity in its maintenance and logistics programs. Comprehensive maintenance and logistics planning is necessary to allow smooth transition and integration of new systems into the NWS meteorological and hydrological operations. To initiate this planning, a Maintenance and Logistics Steering Group (MLSG) was formed to study and recommend action necessary to ensure appropriate NWS maintenance and logistics programs in the 1990's. NOAA technical memorandum NWS ENG-11 describes the MLSG analyses and contains the resulting recommendations. GRA

N86-22066# National Oceanographic Data Center, Washington, D. C.
MARINERS WEATHER LOG, VOLUME 29, NUMBER 3: SUMMER, 1985
1985 68 p
(PB86-108313) Avail: NTIS HC A04/MF A01 CSCL 04B

Weather observations for marine areas are described. Articles included are: Great Lakes Navigation Season, 1983; Marine Observation Program; tips to the radio officer; and Marine Weather Review. Author

N86-22067# National Center for Atmospheric Research, Boulder, Colo.
RELATIVE ACCURACY OF ALPEX AIRCRAFT DATA: AN EVALUATION OF THE ALPEX INTERCOMPARISON FLIGHT WITH THE NCAR (NATIONAL CENTER FOR ATMOSPHERIC RESEARCH) ELECTRA, THE NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION P3 AND THE DFVLR (DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTAIT FUER LUFT-UND RAUMFAHRT) FALCON
Hans Richner Jul. 1985 90 p
(PB86-100823; NCAR/TN-238+STR) Avail: NTIS HC A05/MF A01 CSCL 04B

During the ALPEX program, three participating large research

aircraft--the NCAR Electra, the NOAA P3, and the DFVLR Falcon--joined for an intercomparison flight. Using the data from this flight, this report lists the relative accuracies for position, pressure, temperature, humidity, horizontal and vertical winds, radio altitude, and radiation (some of these quantities were measured by two aircraft only). The results are presented in form of basic statistical data such as mean differences, standard deviations, and correlation coefficients, as well as in form of power, coherence and--for some quantities--phase spectra. GRA

N86-22068# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
STUDIES OF COMPLEX-TERRAIN FLOWS USING ACOUSTIC REMOTE SENSORS
W. D. Neff and C. W. King Apr. 1985 138 p refs
(PB86-100138; ASCOT-85-1) Avail: NTIS HC A07/MF A01 CSCL 04B

Sodars have now been deployed extensively n the ASCOT complex-terrain studies. How these instruments were used, what was learned from them, and how they may be applied to future studies is detailed. Sodar instrumentation and the theory that underlies its use is described. Bistatic and monostatic Doppler methods, data processing using the complex-covariance technique, and limitations in mean-wind and turbulence measurements are compared. A guide to the interpretation of sodar facsimile records including the origin and maintenance of echo layers in complex terrain is provided. Using a second order 1-D numerical model, it is found that only slight accelerations are required to create and maintain the many echo layers found in the transition layer above the nocturnal drainage. The model was used to calculate the rate of turbulent errosion into the cool air that often pools over the Collayomi Valley finding values up to 4 m/h. A detailed analysis of data from four ASCOT experiments is provided. The section begins with a climatology of the wind in the Anderson/Putah Creek Valley using almost 100,000 20-min wind averages obtained from a Doppler sodar that operated from July through December 1979. Author

N86-22069# National Weather Service, Garden City, N.Y.
WXR: WEATHER WIRE REFORMATTING PACKAGE (VERSION 3.00) REVISED
H. Opitz Aug. 1985 67 p refs
(PB85-100815; NOAA-NWS-ERCP-24-Rev) Avail: NTIS HC A04/MF A01 CSCL 04B

WXR is a hydrologic weather wire and PLT product software package which manipulates decoded SHEF hydrologic data according to runtime command line options. WXR coordinates execution with various master format parameter files. The master format parameter files contain the actual output format for specific weather wire products and are assembled during an initial setup phase. Multiple master files may be assembled for various output formats. The operator decides, via command line input, which file(s) WXR will use. WXR will also create, at the operator's option, an intermediate PLT product. The PMOD package can then be used to transform this into a graphic product displayable on an AFOS GDM. WXR uses two other programs. Each program has a complex command line with several processing options. Probably the best approach for routine use is to construct a macro. GRA

N86-22070# National Weather Service, Kansas City, Mo.
RELIABILITY OF THE BOW ECHO AS AN IMPORTANT SEVERE WEATHER SIGNATURE. OBSERVATION OF BOW ECHOES WITH THE MARSEILLES RADAR SYSTEM
R. W. Przbylinski, W. J. Gery, and J. E. Wright Sep. 1985 25 p refs
(PB86-102340; NOAA-NWS-CR-76; NOAA-TM-NWS-CR-77) Avail: NTIS HC A02/MF A01 CSCL 04B

From the 1960's into the mid 1970's, numerous authors have considered the hook echo and the line echo wave pattern (LEWP) to be widely accepted radar signatures associated with severe weather. In recent years, a tremendous amount of research has been conducted on the radar characteristics of severe thunderstorms. Lemon (1980) introduced a method for detecting severe weather echoes according to their structure, intensity, and evolution. In recent years a more extensive effort in detecting severe local storms by utilizing the latest radar techniques has been conducted by National Weather Service (NWS) personnel at the Indianapolis Weather Service Forecast Office. This paper presents preliminary statistical results of a continuing study which evaluates the effectiveness of the bow echo as a severe weather indicator. GRA

N86-22071# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR MID-SEPTEMBER TO MID-OCTOBER 1985, VOLUME 39, NUMBER 18: SEPTEMBER 14, 1985
14 Sep. 1985 10 p
(PB86-104684) Avail: NTIS HC A02/MF A01 CSCL 04B

The precipitation and temperature weather outlook for periodic and seasonal variations for North America are given for September and October. Distribution and probabilities are mapped. E.R.

N86-22072# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR SEPTEMBER 1985, VOLUME 39, NUMBER 17: AUGUST 30, 1985
30 Aug. 1985 10 p
(PB86-101672) Avail: NTIS HC A02/MF A01 CSCL 04B

The precipitation and temperature weather outlook for periodic and seasonal variations for North America are given for September. Distributions and probabilities are mapped. E.R.

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-22073# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
SPECTRAL ANALYSIS OF COLUMBIA RIVER ESTUARY CURRENTS Final Report
Barbara P. Donnell and William H. McAnally, Jr. Sep. 1985 123 p
(AD-A161609; WES/TR/HL-85-5) Avail: NTIS HC A06/MF A01 CSCL 08/8

A spectral analysis study was conducted to determine if wind-induced currents within the Columbia River estuary were sufficiently large to justify their inclusion in a numerical model of sediment transport within the estuary. Completion of the analysis showed that wind-induced current velocities were considerably less than 0.5 fps and consequently have little effect on instantaneous sediment transport. GRA

N86-22074# JAYCOR, Alexandria, Va.
WIND DRIVEN OCEAN MODELING AND OCEAN MODEL DEVELOPMENT Final Report
Alan Wallcraft, Tamara Townsend, and Darren Grant Oct. 1985 89 p
(Contract N00014-83-C-0464)
(AD-A161742; J665-85-006/6251) Avail: NTIS HC A05/MF A01 CSCL 08/3

Numerical simulations were performed with a 0.2 deg, two layer, free surface, primitive equation, ocean circulation model of the Gulf of Mexico with a realistic bottom topography and coastline. As in previous simulations, with idealized bottom topography and coastline, realistic Loop Current behavior could be obtained without wind forcing and with constant inflow through the Yucatan Straits. However, simulations with both wind and port forcing showed significantly more variation than those with port forcing alone. A similiar two layer model was set up for a North Atlantic region, from 20N, 82W to 48N, 30W, on a 0.25 by 0.2 deg grid. A Black Box multigrid package was prepared for solving finite difference Helmholtz's equations with staggered grid Neumann boundary

conditions in nonrectangular regions. In semi-implicit free surface primitive equation ocean models, it is competitive with other powerful iterative methods but slower than the direct Capacitance Matrix Technique. Several wind stress data sets were prepared for use in ocean models, based on global analysis products from FNOC and NMC, regional analysis products from FNOC, and ship observations. These data sets have been used to drive ocean circulation model of the World Ocean, the Indian Ocean, the North Atlantic, and the Western Mediterranean Sea. GRA

N86-22075# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
CZCS (COASTAL ZONE COLOR SCANNER) ATLAS OF WATER OPTICAL PROPERTIES IN THE ALBORAN SEA Final Report
Robert Arnone and Ramon Oriol Aug. 1985 28 p
(AD-A162503; NORDA-117) Avail: NTIS HC A03/MF A01 CSCL 08/10

Optical water properties of the world oceans can be rapidly obtained from data from the Coastal Zone Color Scanner (CZCS) aboard the Nimbus -7 satellite. Satellite processing techniques have been developed to eliminate the atmospheric contamination that contributes 90% of the total visible channel signal. The remaining signal, which constituted the ocean color, is directly related to the diffuse attenuation coefficient (k) at 490 nanometers for the upper surface waters. Calculation and geographic registration of k can be done for each of the 800-square-meter pixel resolution of CZCS, and results show that the accuracy is within 25% of ship measurements. This report indicates the processing procedures used to calculate k from radiance data from the CZCS. GRA

N86-22076# Rhode Island Univ., Kingston. Graduate School of Oceanography.
PROCEEDINGS OF THE GULF STREAM WORKSHOP HELD AT WEST GREENWICH, RHODE ISLAND ON 23-26 APRIL 1985
D. R. Watts Apr. 1985 581 p Workshop held in Greenwich, Rhode Island, 23-26 Apr. 1985
(Contract N00014-85-G-0322)
(AD-A162506) Avail: NTIS HC A25/MF A01 CSCL 08/3

Topics included: Modeling of the Gulf Stream System - Local dynamics and non-local effects; Recent Gulf Stream Theoretical Work and Pertinent Observations; Data Assimilation, Mesoscale Dynamics and Dynamical Forecasting; Two Recent Views of the Gulf Stream East of Cape Hatteras; Modification of an Intense Oceanic Current system Flowing into a Region of Cooling; Bimodality in the Gulf Stream; Isopycnal RAFOS Floats and the Dynamics of Gulf Stream Meanders; Sea-surface Height by GEOSAT-A Altimetry; Structure of the Gulf Stream as Derived from an EOF Analysis; Gulf Stream Envelope and Mean Path between 75 deg. and 58 deg; Maximum Gradient Inverse for the Gulf Stream System; Frontal Geostrophic Dynamics; Analysis of Gulf Stream Mean Flow Energetics off Charleston, S.C.; Nonlinear Waves and Coherent Vortex Structures in Barotropic Beta-Plane Jets; Spatial Structure of Gulf Stream Current Variability Downstream of the New England Seamount Chain; Recirculation and the Deep Gulf Stream; Eddy-resolved Ocean Circulation Related to the Gulf Stream Region; Partial Solutions for Inertial Western Boundary Current with Continuous Stratification; Time Scales and Structure of Topographic Rossby Waves and Meanders in the Deep Gulf Stream. GRA

N86-22077# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
COMPREHENSIVE FINAL REPORT FOR THE MARINE SEISMIC SYSTEM PROGRAM Final Report
J. D. Ward and J. A. Ballard Aug. 1985 231 p
(ARPA Order 4152)
(AD-A162539; NORDA-111) Avail: NTIS HC A11/MF A01 CSCL 08/11

The Marine Seismic System program demonstrated that the technology exists to place large instrument packages, carried external to the drill string, in deep-ocean boreholes using a single deployment vessel. Operating depths of 20,000 ft are feasible, with borehole depths to 2000 ft below the ocean floor. Large, heavy, long-term data recording packages may be deployed on the sea floor and recovered by vessels with adequate winch and navigation systems. Seismic data collected by the Marine Seismic System are generally superior to ocean-bottom seismometer data. Signal/noise ratios of borehole instruments exceed those of ocean bottom seismometers by more than 15 dB in the 1 to 15 Hz frequency band. Subsequent to the 1983 expedition, the Marine Seismic System program was terminated. The borehole instrument package and a dummy bottom processing package remain at the 1983 experiment site. No existing programs are presently designed for continued development of a permanent marine seismic station. GRA

N86-22078# National Oceanic and Atmospheric Administration, Seattle, Wash. Marine Environmental Lab.
PACIFIC MARINE ENVIRONMENTAL LABORATORY Report, Fiscal Year 1984
Jan. 1986 68 p
(PB86-105525) Avail: NTIS HC A04/MF A01 CSCL 08C

Pacific Marine Environmental Laboratory (PMEL) is one of nine research laboratories within the Environmental Research Laboratories (ERL), Office of Oceanic and Atmospheric Research (OAR) of the National Oceanic and Atmospheric Administration (NOAA). PMEL, which is located in Seattle, Washington, carries out scientific investigations in physical, chemical and geolocial oceanography, marine meteorology, and related disciplines in support of NOAA's missions to protect human health and safety from marine hazards and to ensure wise development of ocean resources. Summaries are provided which given an overview of each program area. GRA

N86-22079# National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Labs.
CURRENT VELOCITY AND HYDROGRAPHIC OBSERVATIONS OF THE STRAITS OF FLORIDA: SUBTROPICAL ATLANTIC CLIMATE STUDY (STACS) 1983 AND 1984
M. J. Ratnaswamy, D. Wilson, and R. L. Molinari Jun. 1985 248 p
(PB86-108602; NOAA-ERL-AOML-5) Avail: NTIS HC A11/MF A01 CSCL 08C

The primary objective of the Sub-Tropical Climate Study (STACS) is to define which oceanographical processes are important in medidional heat flux. As the Florida Current has been shown to play an important role in this flux, the initial emphasis of STACS was to develop the capability to monitor the variability of oceanic heat and mass transport in the Strait of Florida. As described, STACS consisted of several separate projects designed to verify the ability of different remote sensing techniques to measure continuously Florida Current velocity, transport and/or temperature. GRA

N86-22080# Northwestern Univ., Evanston, Ill. Center for Urban Affairs and Policy Research.
FIVE YEAR PROGRAM STRATEGY FOR GREAT LAKES NATIONAL PROGRAM OFFICE, 1986-1990
P. L. Wise, K. Fuller, and L. Botts Aug. 1985 54 p
(Grant EPA-R-005804)
(PB86-107984; EPA-905/9-85-002) Avail: NTIS HC A04/MF A01 CSCL 08G

A five year progra strategy for the Great Lakes National Program Office of the Environmental Protection Agency (EPA) is presented. This office coordinates with other EPA programs and with other agencies to support activities that benefit the Great Lakes and assist implementation of the Great Lakes Water Quality Agreement with Canada. The program strategy is to inform other EPA programs, federal agencies and the states how the Great Lakes Office will address its longterm goals from 1986 to 1990. GRA

N86-22081# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmental Science.
COMPREHENSIVE OCEAN-ATMOSPHERE DATA SET (COADS), RELEASE 1

R. J. Slutz, S. L. Lubker, S. D. Woodruff, R. L. Jenne, and P. M. Steurer Apr. 1985 263 p refs Sponsored in part by NOAA, NSF, Natl. Environmental Satellite, Data and Information Service, and by Equatorial Pacific Ocean Climate Studies Prepared in cooperation with NOAA, Boulder, Colo., National Climatic Center, Asheville, N.C., and by National Center for Atmospheric Research, Boulder, Colo.
(PB85-105723) Avail: NTIS HC A12/MF A01 CSCL 04B

Global marine data observed during 1854 to 1979, primarily by ships-of-opportunity, have been collected, edited, and summarized statistically for each month of each year of the period, using 2 deg latitude x 2 deg longitude boxes. Products now available in a first release from this Comprehensive Ocean-Atmosphere Data Set (COADS) include fully quality-controlled (trimmed) reports and summaries. Each of the 70 million unique reports contains 28 elements of weather, position, etc., as well as flags indicating which observations were statistically trimmed. The summaries give 14 statistics, such as the median and mean, for each of eight observed variables of air and sea surface temperatures, wind, pressure, humidity, and cloudiness, plus 11 derived variables. Author (GRA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-22082# Gordon Research Conferences, Inc., Kingston, R.I.
PROCEEDINGS: PROTONS AND MEMBRANE REACTIONS HELD AT SANTA BARBARA, CALIFORNIA ON 28 JANUARY - 1 FEBRUARY 1985
Lester Packer and David Deamer 9 Oct. 1985 28 p
(Contract N00014-85-G-0055; DA Proj. RR0-4108)
(AD-A161331) Avail: NTIS HC A03/MF A01 CSCL 06/1

The Proceedings of the Confeence on Protons and Membrane Reactions which took place at Santa Barbara, California, on 28 January to 1 February, 1985, included the following topics: Intracellular Water Structure/Translocation; Concepts and Principles of Membrane Proton Conduction Pathways; Translocation of Protons/Water through Lipsomes and Model Systems; Non Bulk Phase vs Bulk Proton Translocation; Translocation of Protons Through Membranes: Bacteriorhodopsin; Transmembrane Proton Translocation by the F sub 0 Moiety of H(+)-ATP (Adenosine Triphosphate) Synthase; Proton Translocation and the Catalytic Process in the H+-ATP Synthase; The Flagellar Motor System; Proton Translocation Through Redox Complexes. GRA

N86-22083# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL PREREQUISITES FOR THE POSSIBLE USE OF BACTERIA WHICH SPLIT ORGANOPHOSPHATES IN ORDER TO INCREASE THE YIELD OF NUTRIENT YEAST AND ITS NITROGEN AND PHOSPHORUS CONTENT
D. L. Shamis 28 Oct. 1985 25 p Transl. into ENGLISH from Trudy Instituta Mikrobiologii i Virusologii, Adademiya Nauk Kazakhskoy SSSR (USSR), v. 11, 1968 p 3-17
(AD-A161811; FTD-ID(RS)T-1393-84) Avail: NTIS HC A02/MF A01 CSCL 06/13

This article reflects the theme of one of the areas of investigation of the Laboratory of Microbial Protein Synthesis, where we are studying the factors which accelerate the conversion (mobility) of macroergic and other phosphorus compounds. The purpose of these studies is to increase the energy supply of the metabolic synthesis reactions connected with the yield and quality of food yeast. Professor Malkov, the author of the idea of the partial inhibition of respiration in order to save carbon, mentions a factor which may be the cause of intensification of the biosynthetic processes of the yeasts he investigated. We are speaking here about the doubled amount of labile phosphorus p7 obtained in yeast as a result of placing it in concentrated orthophosphate. In our investigations the increased labile phosphorous content is connected with the biosynthetic activity of the yeast. The article correlates many studies which show the very important role of ATP and polyphosphates as energy accumulators and transporters, and presents data from the literature and preliminary results of our own investigations which indicate the exceptional effectiveness of making practical use of the phenomena of microbial synergism and metabiosis. Bacteria which split orthophosphates were studied on the basis of these results. There is also significant interest in the phosphates activity of food yeast using organophosphates as a phosphorus source. GRA

N86-22084# Minnesota Univ., Duluth. Dept. of Medical Microbiology and Immunology.
SUPPRESSION OF ANTIBODY FORMING CELLS BY MURAMYL DI-PEPTIDES Final Report, Aug. 1982 - Nov. 1985
Mariko Wakai and Arthur G. Johnson 1 Dec. 1985 25 p
(Contract N00014-82-K-0635; RR0-4108)
(AD-A162400) Avail: NTIS HC A02/MF A01 CSCL 06/5

Non-toxic synthetic adjuvants are under prime consideration for use in increasing the immune response of human beings. Three of microbial origin are the muramyl di-peptides (N-acetyl-muramyl-L-alany-D-isoglutamine and analogs, termed MDP), polyadenylic acid polyuridylic acid-polyuridylic acid complexes termed poly A-poly U) and the recently isolated monophosphoryl lipid A. While each of these has been demonstrated in animals to be active in increasing the immune response when given with the antigen, each also has been found to suppress this response when given one to several days before antigen. The enhancing actions of MDP and poly A-poly U have been well characterized. However, characterization of the suppressive phenomenon has been minimal, but it is important to gain a responsible understanding of how these adjuvants regulate the immune response non-specifically. Accordingly, the experiments proposed during the tenure of this contract were undertaken to further knowledge of how each of these adjuvants activate the suppressive arm of the immune response. GRA

N86-22085# Minnesota Univ., Duluth. Dept. of Medical Microbiology and Immunology.
STUDIES ON THE MECHANISM OF SUPPRESSION OF THE IMMUNE RESPONSE BY SYNTHETIC, NON-TOXIC ADJUVANTS Final Report, Aug. 1982 - Nov. 1985
Arthur G. Johnson, Marilyn J. Odean, Mariko Wakai, and Mark Tomai 1 Dec. 1985 26 p
(Contract N00014-82-K-0635; RR0-4108)
(AD-A162444) Avail: NTIS HC A03/MF A01 CSCL 06/5

The immunomodulatory action of a non-toxic monophosphoryl lipid A (MPL) and a toxic diphosphoryl lipid A (DPL) fraction derived from endotoxins of the heptoseless mutants of bacteria were compared. Both derivatives retained the ability characteristic of lipopolysaccharides, to enhance antibody formation in young adult mice when injected along with antigen and suppress antibody production when given a day before antigen. In aging mice, a model of immunodeficiency, a marked restoration of antibody formation was observed when antigen was injected together with either MPL or DPL. Levels of antibody in these aging mice were comparable to those observed in young adult mice. Moreover, both MPL and DPL enhanced antibody production significantly in the endotoxin low-responder mouse strains, C3H/HeJ and C57Bl/10 ScN, whereas, phenol-water extracted endotoxin from an R-7 mutant was ineffective. MPL and DPL also acted as suppressive agents when administered prior to antigen in the C3H/HeJ strain. Thus, the results from these studies show that (a) the toxic properties of lipid A can be removed without eliminating immunomodulating activity, and (b) such lipidic compounds can overcome the immunologic lesions of immunodeficient and hyporesponsive animals. GRA

N86-22086# California Univ., Berkeley. Dept. of Microbiology and Immunology.
MOLECULAR AND BIOLOGICAL PROPERTIES OF AN IMMUNOPOTENTIATING COMPLEX POLYSACCHARIDE ADJUVANT PRODUCED BY A GLIDING BACTERIUM Annual Report, 1 Jul. 1984 - 30 Jun. 1985

Robert I. Mishell and William R. Usinger 13 Dec. 1985 15 p
(Contract N00014-84-K-0626)
(AD-A162664) Avail: NTIS HC A02/MF A01 CSCL 06/15

Gliding bacteria adjuvant (GBA) is composed of macromolecular substances secreted or shed into the growth media of a newly described Cytophaga species. We had established prior to the onset of this contract that GBA strongly augments the in vitro generation of humoral immunity by mouse spleen cells and that it is mitogenic for murine spleen cells. Since GBA is very water soluble, its absorbance at 280 nm is low, and its biological activities are stable to boiling, we hypothesized that GBA was a polysaccharide or a complex of polysaccharides. Our principle objectives during the first year of this contract were to develop methods for large scale production and purification of GBA, to initiate studies of its physical and chemical properties, to prepare a panel of monoclonal antibodies against GBA for future studies defining its biologically significant epitopes and to extend studies of its biological activities. Large scale production and purification have been essentially achieved using protocols described in this report. Knowledge of the biological activities of GBA for mammalian cells was extended this year. Titration curves with the most highly purified preparations of GBA were performed with assays measuring in vitro adjuvanticity, mitogenicity, B cell polyclonal activation and induction of the murine macrophage cell line, WEHI 265, to secrete IL-1. Studies on the mechanism of action of GBA were initiated. GRA

N86-22087# Northeastern Univ., Boston, Mass. Dept. of Biology.
LYMPHOCYTE ACTIVATION - REGULATORY SUBSTANCES Final Report, Jun. 1982 - Sep. 1985
Phyllis R. Strauss 10 Dec. 1985 8 p
(Contract N00014-82-C-0283)
(AD-A162683) Avail: NTIS HC A02/MF A01 CSCL 06/16

Initially, the objectives of this work were to characterize substances which regulated DNA synthesis in lymphocytes. In particular we wished to determine the role of detergent soluble (DS)DNA in replication of activated splenocytes. We now feel that DS DNA is a hitherto overlooked class of replication intermediates not yet stabilized by nucleosome maturation. One possibility is that the detergent lability arises because of the presence of topoisomerase II in the replicating region which results in the release of these fragile fragments. These observations hold not only in activated lymphocytes but also in any actively dividing cell. GRA

N86-22088# Tel-Aviv Univ. (Israel). Dept. of Chemistry.
BIMANE DERIVATIVES AS FLUORESCENT PROBES FOR BIOLOGICAL MACROMOLECULES Periodic Report, No. 4, Jul. - Dec. 1985
Edward M. Kosower Dec. 1985 16 p
(Contract DAJA45-83-C-0057)
(AD-A162725) Avail: NTIS HC A02/MF A01 CSCL 07/3

Nine years ago, a convenient syntheses for a new class of heterocyclic molecules, the bimanes or 1,5-diazabicyclo(3.3.0) octadienediones was discovered and developed. In the course of preparing the bromo derivatives, fortuitously that proteins were fluorescently labeled by bromobimanes. It was established that bromobimanes reacted preferentially with thiols, and usefulness of such labeling for both small and large molecules in biological systems was demonstrated. Many applications of the agents have been reported. The primary aims of our research on the bimanes are divided into the following areas: (1) synthesis, (2) reactivity, (3) photophysics, and (4) application to macromolecules. Although we have a number of new results, it seems pertinent to base this report on a new summary of the application of bimane labeling to thiols. GRA

N86-22089# Ohio State Univ., Columbus. Dept. of Microbiology.
DEVELOPMENT AND USE OF ANUCLEATED BACTERIAL CELLS TO ASSAY THE IN VIVO ACTIVITY OF POLLUTANTS Final Report, Apr. 1981 - Jul. 1985
John N. Reeve and Jacqueline B. Rice 31 Jul. 1985 93 p
(Grant AF-AFOSR-0087-81)
(AD-A162727; AFOSR-85-1136TR) Avail: NTIS HC A05/MF A01 CSCL 06/13

There were 2 objectives in this research project: development of an in vivo assay for mistranslation-inducing activity of pollutants and characterization of amino acid substitutions. The first objective proved to be the more difficult. The T7 0.3 gene product (0.3 protein) was purified by a modification of the published procedure, and used to raise rabbit antibody to this protein. A radioimmune precipitation assay was developed which could be used to estimate increased misincorporation of cysteine into 0.3 protein. A sample assay involving only counting of the radioimmune precipitate was not achieved because we were not able to obtain the 0.3 protein free of contaminating proteins in the RIP. The 2nd objective proved more fruitful. The cysteine substitution sites in the N-terminal 42 positions of 0.3 protein have been successfully identified. Cleavage of 0.3 protein with trypsion to identify cysteine for arginine substitutions showed that the major sites of cysteine misincorporation were at residues other than arginine. Sequencing of (35S) cysteine-labeled 0.3 protein showed that the most frequent substitution was at residue 15 (tyrosine) and other substitutions were at a positions 9 (asparagine), 12 (aspartate), 41 (alanine) and 42 (aspartqate). GRA

N86-22090# Charles F. Kettering Research Lab., Yellow Springs, Ohio.
PARTICULATE MODELS OF PHOTOSYNTHESIS Progress Report
G. R. Seely Oct. 1985 27 p refs
(Contract DE-FG02-84ER-13187)
(DE86-001625; DOE/ER-13187/2) Avail: NTIS HC A03/MF A01

Studies are reported on the photochemical and physical properties of chlorophyll while associated with various surfactants onto polyethylene particles. Results to date have shown that the forms of chlorophyll association are specific to the surfactant; furthermore, when chlorophyll is ligated by the surfactant, even dense associations are fluorescent, but when the ligating surfactant contains a reducible group like quinone, the fluorescence is strongly suppressed. DOE

N86-22091# Oak Ridge National Lab., Tenn.
BIOMEDICAL AND ENVIRONMENTAL SCIENCES AT OAK RIDGE NATIONAL LABORATORY
1985 47 p
(Contract DE-AC05-84OR-21400)
(DE86-001639; ORNL/M-88) Avail: NTIS HC A03/MF A01

The themes, activities, and facilities of the Biomedical and Environmental Sciences Program at Oak Ridge National Laboratory are described. Programs discussed include those in the Biology Division, Environmental Sciences Division, Health and Safety Research, and the Biotechnology Program. DOE

N86-22092# Science Applications International Corp., La Jolla, Calif.
JAPANESE TECHNOLOGY EVALUATION PROGRAM (JTECH): BIOTECHNOLOGY PANEL Final Report
D. Oxender, C. Cooney, D. Jackson, G. Sato, and R. Wickner Jun. 1985 171 p Sponsored in part by Department of Commerce, Washington, D.C.
(Contract TA-83-SAC-02254; Grant NSF PRA-85-13755)
(PB86-109386; JTECH-TAR-8404; NSF/PRA-85016) Avail: NTIS HC A08/MF A01 CSCL 06E

Japanese research and development in several of the main areas of biotechnology, including biochemical process technology, biosensors, cell culture technology, protein engineering, and recombinant DNA technology are assessed. Japan's strategic planning in biotechnology is based on a 10 to 15 year time scale, whereas most similar planning and resource commitment in the United States is based on a 3 to 5 year time scale. This difference in time scale is thought to be partially responsible for Japan's apparently more technology-driven than market-driven resource commitment. It is noted that much of the commercialization of

biotechnology in Japan is being carried out by large established companies and that Japan has a well-established coordination of the development of biotechnology by industry, universities, and government groups. GRA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-22093* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 282)
Mar. 1986 67 p
(NASA-SP-7011(282); NAS 1.21:7011(282)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 154 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1986. Author

N86-22094*# National Aeronautics and Space Administration, Washington, D.C.
THE HISTORY OF AERONAUTICAL MEDICINE IN VENEZUELA
David R. Iriarte Feb. 1986 20 p Transl. into ENGLISH of "Historia de la Medicina Aeronautica en Venezuela" presented at the 6th Seminar of Aeronautical Medicine, 1985 p 1-15 Seminar held in Caracas, Venezuela, 27-28 Sep. 1985 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77709; NAS 1.15:77709) Avail: NTIS HC A02/MF A01 CSCL 06E

The Aerial Medical Service of the Ministry of Transportation and Communications of Venezuela was created on June 1949, and later became the Department of Aeronautical Medicine. Its functions include the medical examinations of future pilots, navigators and flight engineers. The importance of good mental and physical health in all flight and ground personnel to ensure the safety of air travel is discussed. Author

N86-22095*# Hershey (Milton S.) Medical Center, Hershey, Pa. Div. of Gastroenterology.
VECTION-INDUCED GASTRIC DYSRHYTHMIAS AND MOTION SICKNESS Annual Report, 1 May 1985 - 30 Apr. 1986
Kenneth L. Koch and Robert M. Stern 1 Apr. 1986 64 p refs (Grant NAG9-118)
(NASA-CR-176620; NAS 1.26:176620; AR-1) Avail: NTIS HC A04/MF A01 CSCL 06S

Gastric electrical and mechanical activity during vection-induced motion sickness was investigated. The contractile events of the antrum and gastric myoelectric activity in healthy subjects exposed to vection were measured simultaneously. Symptomatic and myoelectric responses of subjects with vagotomy and gastric resections during vection stimuli were determined. And laboratory based computer systems for analysis of the myoelectric signal were developed. Gastric myoelectric activity was recorded from cutaneous electrodes, i.e., electrogastrograms (EGGs), and antral contractions were measured with intraluminal pressure transducers. Vection was induced by a rotating drum. gastric electromechanical activity was recorded during three periods: 15 min baseline, 15 min drum rotation (vection), and 15 to 30 min recovery. Preliminary results showed that catecholamine responses in nauseated versus symptom-free subjects were divergent and pretreatment with metoclopramide HC1 (Reglan) prevented vection-induced nausea and reduced tachygastrias in two previously symptomatic subjects. Author

N86-22096# National Aerospace Lab., Tokyo (Japan).
ELECTRODERMAL CHANGES CORRESPONDING TO THE DEGREE OF DISCOMFORT INDUCED BY MOTION SICKNESS
1985 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-880; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

The qualitative correspondence between the degree of discomfort induced by motion sickness and the following electrodermal changes was examined; skin potential level (SPL), skin resistance level (SRL), and skin potential reflex (SPR). A depolarizing change in SPL and a lowering of SRL were observed which corresponded to lasting discomfort. These changes were detected in the thermal sweat areas. It was suggested that the change in SPL also occured in the arousal sweat area. Arousal response appears in the arousal sweet area rather than in the sweat areas. SPL showed better correspondence than SRL, especially in the time required for recovery after the discomfort stimulation. On the other hand, SPR was observed in the arousal sweat area accompanied by transient discomfort induced by Corioils stimulus. It was indicated that the amplitude of the positive wave (P wave) in SPR might correlate quantitatively to the degree of discomfort. SPR was not remarkably detected in the thermal sweat areas. Author

N86-22097# California Univ., Irvine, Dayton, Ohio.
TOXIC HAZARDS RESEARCH UNIT ANNUAL TECHNICAL REPORT: 1985 Report, Jun. 1984 - May 1985
J. D. MacEwen and E. H. Vernot Sep. 1985 202 p
(Contract F33615-80-C-0512)
(AD-A161558; AAMRL-TR-85-058; Rept-22) Avail: NTIS HC A10/MF A01 CSCL 06/20

The research program of the Toxic Hazards Research Unit (THRU) for the period of June 1984 through May 1985 is reviewed in this report. Chronic toxicity and oncogenic studies were carried out with hydrazine, JP-4, and JP-8. Results of histopathologic examination became available for a number of studies including chronic inhalation exposures to monomethylhydrazine, methylcyclohexane, and Otto Fuel II; and subchronic to petroleum and oil shale diesel fuel marine. These studies are now complete. Other investigations are complete except for histopathologic results. These include chronic exposures to petroleum JP-4, RJ-5, JP-7, JP-TS, and JP-10; subchronic exposures to petroleum JP-4 and JP-8; and weekly exposures to hydrazine. Three studies have concluded the exposure phases and are now being held postexposure - 90 day continuous exposures to shale JP-4 and dimethyl methylphosphonate and rat strain susceptibility to shale JP-4. A series of short-term toxicity studies was conducted on a variety of chemicals and chemical agents used by the Army, Air Force, and Navy. GRA

N86-22098# Naval Health Research Center, San Diego, Calif.
MECHANISMS OF BIOENERGETIC HOMEOSTASIS DURING EXERCISE: A GENERAL MODEL Interim Report
Charles G. Gray May 1985 27 p
(MR0-00001)
(AD-A161678; NAVHLTHRSCHC-85-19) Avail: NTIS HC A03/MF A01 CSCL 06/16

Studies over the past several years have identified limitations of substrate utilization as a primary determinant of physical endurance capacity. These studies have shown that muscles have a preference and a great capacity to utilize fats as a source of energy. However, the prepoderance of these studies have been directed at extending endurance by increasing glucose availability through increasing muscle glycogen stores or supplementing endogenous glucose supplies during exercise with various forms of sugar containing solutions. Some studies have shown that oral administration of glucose solutions during exercise can improve performance, while prefeeding with glucose decreases endurance performance. However, physical training and adaption to low carbohydrate diets drive the system toward greater fatty acid oxidation during exercise. The main problem appears to be integration of the observed effects of training and dietary manipulation into a comprehensive solution for maximizing physical endurance under a variety of circumstances. This report presents a brief review of information of the mechanisms which regulate cellular substrate metabolism in the central nervous system, liver, muscles, and adipose tissue. The concepts are organized into a systematic metabolic model which interlaces the mechanisms at work within each subsystem. Examples of regulation of substrate

flows is presented for exercise under three conditions: fasted, post-prandial, and after adaptation to a low carbohydrate diet. By using the proposed scheme of integrative metabolism, complex dietary and physical training programs for extending endurance performance are suggested. GRA

N86-22099# Thermedics, Inc., Woburn, Mass.
DEVELOPMENT OF AN ULTRAFAST-CURING WOUND DRESSING Annual Report, 30 Sep. 1983 - 30 Sep. 1984
Michael Szycher and Jonathan L. Rolfe 15 Mar. 1985 31 p
(Contract DAMD17-83-C-3240; DA Proj. 3S1-62775-A-825)
(AD-A162471; TE4337-53-85) Avail: NTIS HC A03/MF A01 CSCL 06/12

This document describes a second-generation, drug-dispensing wound dressing. The wound dressing, which can be applied by the wounded soldier himself, incorporates thrombin as a coagulant to stop bleeding, and gentamycin sulfate as a wide-spectrum antibiotic to prevent bacterial infection. The new would dressing is a trilaminate composite. The air side of the trilaminate is a fabric impregnated with an aliphatic, medical grade polyurethane elastomer; the middle laminate is a controlled release layer, containing the microencapsulated pharmacoactive agents, and the third laminate is a 1.0-mil-thick layer of acrylic-based, pressure-sensitive adhesive. The middle layer is fabricated from a mixture of urethane and silicone oligomers, which are pre-compounded with pharmacoactive agents, and is subsequently solidified (cured) upon mere exposure to low-intensity UV radiation at room temperature. Solidification at room temperature is a vital consideration, because most drugs are rapidly inactivated upon mild heating. Once cured, the oligomer layer containing pharmacoactive agents becomes a controlled-release monolith, capable of dispensing drugs at a continuous and predictable rate. GRA

N86-22100# Iowa Univ., Iowa City. Coll. of Medicine.
THE ROLE OF ENDORPHINS IN THE PATHOPHYSIOLOGY OF HEMORRHAGIC AND ENDOTOXIC SHOCK IN THE SUBHUMAN PRIMATE Annual Report, 1 Jun. 1980 - 31 May 1981 and Final Report, 15 Sep. 1981 - 15 Mar. 1985
Nelson J. Gurll, David G. Reynolds, Thomas Vargish, and Carl V. Gisolfi 15 Mar. 1985 65 p
(Contracts DAMD17-80-C-0094; DAMD17-81-C-1177; DA Proj. 3S1-62772-A-874)
(AD-A162483) Avail: NTIS HC A04/MF A01 CSCL 06/15

In order to investigate the pathophysiological role of endogenous morphine-like substances (endorphins) in shock, we studied cynomolgus monkeys and dogs subjected to hemorrhagic or endotoxic shock. Blockade of opiate receptors with naloxone improved cardiovascular function and survival in both species and both models but requires correction of acidosis and hypothermia. Shock is associated with elevations in plasma levels of endorphins. Using different sites of injection and various anatomical and pharmacological ablations, we have shown that naloxone's beneficial effects in hemorrhagic shock are due to potentiation of the effect of released catecholamines on cardiac opiate receptors. The myocardial depression found in shock is due to an endorphin-mediated attenuation of catecholamine activity on the heart. We believe this is mediated by interaction with cardiac receptors and is expressed via G-protein activation of adenylate cyclase and cyclic-AMP. This hypothesis needs to be tested by biochemical determination of these substances, and our observations need to be extended to endotoxic shock. Nevertheless, naloxone and other antiendorphin substances may be important in the treatment of shock by reversing one of the important pathophysiological mechanisms of cardiovascular depression. GRA

N86-22101# Pennsylvania State Univ., University Park. Dept. of Industrial and Management Systems Engineering.
INCORPORATION OF ACTIVE ELEMENTS INTO THE ARTICULATED TOTAL BODY MODEL Final Report, 26 Sep. 1983 - 30 Jun. 1985
Andris Freivalds 30 Jun. 1985 113 p
(Contract F33615-83-C-0506)
(AD-A162518; AAMRL-TR-85-061) Avail: NTIS HC A06/MF A01 CSCL 06/16

The Articulated Total Body (ATB) Model, based on rigid-body dynamics with Euler equations of motion and Lagrange type constraints, is used by the Harry G. Armstrong Aerospace Medical Research Laboratory to predict the forces and motions experienced by air crew personnel in typical flight operations. To provide a more realistic representation of human dynamics, active neuromusculature was added to the ATB Model using elements of the newly developed advanced harness system. A lumped three-parameter muscle model with a contractile element, a damping element and a parallel elastic element was developed. The contractile element included a length-tension relationship, a force-velocity relationship and an active state function. The basic fiber mechanisms were integrated into muscle systems utilizing motor unit organization, orderly recruitment of motor units and adjustments in force due to fatigue and reflex action. The complete muscle systems were then used to replicate the human neuromusculature of the trunk and neck and for the elbow, shoulder, hip and knee joints. GRA

N86-22102# Army Research Inst. of Environmental Medicine, Natick, Mass.
HEAT ACCLIMATIZATION DEVELOPED DURING SUMMER RUNNING IN NORTHEASTERN UNITED STATES
Lawrence E. Armstrong, Roger W. Hubbard, Jane P. DeLuca, and Elaine L. Christensen Dec. 1985 27 p
(DA Proj. 3E1-62777-A-879)
(AD-A162728) Avail: NTIS HC A03/MF A01 CSCL 06/16

Five highly trained distance runners (DR) were observed during controlled 90-min thermoregulation trials in spring and late summer to document the extent of heat acclimatization developed during summer running in Northeastern United States. These trials simulated environmental and exercise stresses encountered by DR during daily training. Between spring and late summer, DR trained outdoors for weeks but consequently showed few physiological adaptations classically associated with HA. Statistical comparison indicated no significant differences in mean heart rate, rectal temperature, sweat, plasma, or change in plasma, volume during exercise; mean weighted skin temperature was unchanged (except at 50 min of exercise) and sweat rate was also unchanged (except during the initial 30 min segments). Significant decreases in submaximal oxygen uptake were observed, at treadmill speeds of 80, 120, and 200 m min respectively. It is conclude that distance runners did not require summer heat exposure to adequately thermoregulate during the spring trial, which simulated the hottest summer days recorded during this study. GRA

N86-22103# California Univ., San Diego, La Jolla.
ADVANCED CLINICAL RESEARCH IN SHOCK AND TRAUMA Final Report, 1976 - Feb 1985
Richard M. Peters Feb. 1985 6 p
(Contract N00014-76-C-0282)
(AD-A162730) Avail: NTIS HC A02/MF A01 CSCL 06/5

This final report covers the years from 1976 through February, 1985. The overall subject of this research has been the best methods of resuscitation and maintaining patients who have hypovolemic shock of major surgery, particularly the support of the cardiac and the respiratory function. The number of subjects covered is described with the years in which those projects were completed and their conclusion. Table I lists the publications that have resulted from these investigations. GRA

N86-22104# Army Research Inst. of Environmental Medicine, Natick, Mass.
AN AUTOMATED SYSTEM FOR COMPREHENSIVE ASSESSMENT OF VISUAL FIELD SENSITIVITY
John L. Kobrick, Adrien R. Lussier, Stephen Mullen, and Calvin Witt Apr. 1985 19 p
(AD-A162755; USARIEM-T10/85) Avail: NTIS HC A02/MF A01 CSCL 06/16

A device for comprehensive assessment of the capability of operators for detection and location of visual signals throughout the functional visual field is described. The system is completely

automated and computerized, and provides documentation files and graphic descriptions of each operator performance immediately upon completion of testing. Sensitivity can be measured for three stimulus colors (red, yellow, green), in a testing situation which mimics commonplace viewing. An abbreviated listing of the main operating program software is provided. GRA

N86-22105# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
MODELING ELECTROCARDIOGRAMS USING INTERACTING MARKOV CHAINS
Peter C. Doerschuk, Robert R. Tenney, and Alan S. Willsky Jul. 1985 64 p
(Grant AF-AFOSR-0258-82)
(AD-A162758; LIDS-P-1491; AFOSR-85-1118TR) Avail: NTIS HC A04/MF A01 CSCL 06/5

A methodology for the statistical modeling of cardiac behavior and electrocardiograms (ECG's) is developed that emphasizes a) the physiological event/detailed waveform hierarchy; and b) the importance of control and timing in describing the interactions among the several anatomical subunits of the heat. This methodology has been motivated by a desire to develop improved algorithms for statistical rhythm analysis that capture cardiac behavior in a more fundamental way but that stops short of complete accuracy in order to highlight decompositions that can be exploited to simplify statistical inference based on these models. The models consist of interacting finite-state processes, where a very few of the transition probabilities for each process can take on a small number of different values depending upon the states of neighboring processes. Each finite-state process is constructed from a very small set of elementary structural elements. The methodology is illustrated by describing models for three cardiac rhythms and include simulation results for one of these, namely the rhythm known as Wenckebach. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-22106 Arizona Univ., Tucson.
VISUAL PERCEPTION IN CORRELATED NOISE Ph.D. Thesis
Kyle Jean Myers 1985 149 p
Avail: Univ. Microfilms Order No. DA8522817

The ability of human observers to perform detection tasks in medical images that contain structured noise was investigated. Physical measures of image quality, such as signal-to-noise ratio (SNR), resolution, modulation transfer function (MTF), and contrast, do not accurately predict how well an observer can detect lesions in an image. For images with equal pixel SNR, humans can detect a low contrast object more readily in images that have a low-pass noise structure, as opposed to a high-pass noise structure. This finding is important in the comparison of images generated by a classical pinhole-imaging system with images generated by a computed tomography imager. A figure of merit was wanted for imaging systems that is more than an evaluation of the physician's performance, measured using human observers and an accepted method such as receiver operating characteristic techniques. The hypothesis is that the human observe acts approximately as an ideal observer who does not have the ability to prewhiten the noise in an image. Without this ability, the ideal observer's detection performance for even a simple task is degraded substantially in correlated noise. This is just the effect found for human observers. Dissert. Abstr.

N86-22107# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
PERSONALITY TYPE ANALYSIS OF AIR FORCE INSTITUTE OF TECHNOLOGY SCHOOL OF SYSTEMS AND LOGISTICS GRADUATE DEGREE 85S CLASS USING MYERS-BRIGGS TYPE-INDICATOR M.S. Thesis
Richard A. Carter Sep. 1985 146 p
(AD-A161053; AFIT/GLM/LSM/85S-11) Avail: NTIS HC A07/MF A01 CSCL 05/10

The objective of this research was to identify significant learning differences in the AFIT School of Systems and Logistics (AFIT/LS) using the personality type theory developed by psychologist Jung and identified by the Myers-Briggs Type Indicator (MBTI). The data were collected from graduate students of AFIT/LS through the MBTI and a Preferred Academic Environment Questionnaire. Results of the MBTI categorized each of the subjects into personality types. The Preferred Academic Environment Questionnaire determined student habits test taking preferences: AFIT situations which the student felt improved academic performance; and AFIT learning situations which were important to the student. The data were analyzed according to the distribution of MBTI type, the effect of MBTI type upon grade point average, and student preference for instructional technique and learning styles as they related to MBTI type. GRA

N86-22108# Naval Submarine Medical Research Lab., Groton, Conn.
THE EFFECTS OF COLOR-CODING IN GEOSIT DISPLAYS. 1: COLOR AS A REDUNDANT CODE Interim Report
Alan R. Jacobsen, David F. Neri, and William H. Rogers 13 Sep. 1985 20 p
(AD-A161107; NSMRL-1061) Avail: NTIS HC A02/MF A01 CSCL 05/8

The effect of color-coding symbols in geographical situation (GEOSIT) displays on response time was studied using 12 observers. Three levels of the threat dimension (friendly, unknown, and hostile) were redundantly coded by both color and shape, while the three levels of the platform dimension (submerged, surface, and airborne) were coded only by shape. Compared to the standard monochrome coding scheme, response time on the color-coded threat dimension was enhanced by over 100%. Performance on the noncolor-coded platform dimension was unaffected by color-coding of the threat dimension. Several other significant effects were also found. This study demonstrates that the use of color in GEOSIT displays can dramatically improve performance without any decrement in performance on noncolor-coded information. GRA

N86-22109# Naval Health Research Center, San Diego, Calif.
HEALTH AND PERFORMANCE OF ANTARCTIC WINTER-OVER PERSONNEL: A FOLLOW-UP STUDY Final Report
Lawrence A. Palinkas Jun. 1985 15 p
(AD-A161773; NAVHLTHRSCHC-85-18) Avail: NTIS HC A02/MF A01 CSCL 06/10

Despite extensive previous research on the health and performance of Antarctic winter-over personnel while they are on the ice, little is known about the long-term effects of the winter-over experience. Using the records of enlisted personnel who applied to the Operation Deep Freeze program between 1963 and 1973, the health and service history data available on these individuals at the Naval health Research Center were examined to determine if incidence rates and performance criteria were significantly different between a group of winter-over personnel and a control group of enlisted personnel who were rated as acceptable by a screening team but who did not winter over. Results indicated that the overall incidence rate for the winter-over group was significantly lower than the rate for the control group. The winter-over group also had significantly fewer first hospitalizations for neoplasms, endocrine, nutritional, and metabolic disorders, and diseases of the musculoskeletal system. Results suggest that wintering over does not adversely affect subsequent health and performance of enlisted personnel, and that the screening program has been successful in selecting the best candidates in terms of these criteria. GRA

N86-22110# Army Construction Engineering Research Lab., Champaign, Ill.
THE ROLE OF VIBRATION AND RATTLE IN HUMAN RESPONSE

TO HELICOPTER NOISE Final Report
Paul D. Schomer and Robert D. Neathammer Sep. 1985 161 p (AD-A162486; CERL-TR-N-85/14) Avail: NTIS HC A08/MF A01 CSCL 05/10

Our understanding of community reaction to helicopter noise remains incomplete. A technique called A-weighting appears to produce realistic data outdoors and at modest noise levels, and the community response in terms of percentage of population highly annoyed can be correlated with respect to the Day/Night Average Sound Level (DNL) descriptor. However, questions remain as to the effect of perceived building vibrations and rattle in human response to helicopter noise. To answer these questions, this study examined the role of vibration and rattle in human response to helicopter noise. Many volunteer subjects were tested under real noise conditions. The helicopter noise was generated by an Army UH-1H (Huey) helicopter. Subjects were located either in the living room of a new mobile home, outdoors, or in the living room or dining room of an old frame farmhouse near Champaign, IL. The control or comparison sound was generated electronically through loudspeakers at each location using a 500-Hz octave band of white noise. By performing paired comparison tests between the helicopter and control noises, it was possible to establish equivalency between these two stimuli. Author (GRA)

N86-22111# Yale Univ., New Haven, Conn. Dept. of Psychology.
ATTENTION WITHIN AUDITORY WORD PERCEPTION Final Report, 1 Jan. 1982 - 31 Dec. 1983
Arthur G. Samuel and William H. Ressler Nov. 1985 58 p
(Contract N00014-82-C-0160)
(AD-A162550; Rept-85-1-ONR) Avail: NTIS HC A04/MF A01 CSCL 06/16

Phonemic restoration is a powerful auditory illusion that arises when a phoneme is removed from a word and replaced with noise, resulting in a percept which sounds like the intact word with a spurious bit of noise. It is hypothesized that the configurational properties of the word impair attention to the individual phonemes and thereby induce perceptual restoration of the missing phoneme. If so, this impairment might be unlearned if listeners can process individual phonemes within a word selectively. Subjects received training with the potentially restorable stimuli (972 trials with feedback); in addition, the presence or absence of an attentional cue, contained in a visual prime preceding each trial, was varied between groups of subjects. Cueing the identity and location of the critical phoneme of each test word allowed subjects to attend to the critical phoneme, thereby inhibiting the illusion, but only when the prime also identified the test word itself. When the prime only provided the identity or location of the critical phoneme, or only the identity of the word, subjects performed identically to those subjects for whom the prime contained no information at all about the test word. Furthermore, training did not produce any generalized learning about the types of stimuli used. A limited interactive model of auditory word perception is discussed, in which attention operates through the lexical level. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-22112* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DROP FOOT CORRECTIVE DEVICE Patent
Bert C. Deis, inventor (to NASA) Issued 28 Jan. 1986 5 p Continuation of US-Patent-Appl-SN-876298, filed 9 Feb. 1978, abandoned
(NASA-Case-LAR-12259-2; US-Patent-4,566,447; US-Patent-Appl-SN-280152; US-Patent-Class-128-80-E) Avail: US Patent and Trademark Office CSCL 05H

A light weight, economical device to alleviate a plurality of difficulties encountered in walking by a victim suffering from a drop foot condition is discussed. A legband girdles the leg below the knee and above the calf providing an anchor point for the upper end of a ligament having its lower end attached to a toe of a shoe or a toe on the foot. The ligament is of such length that the foot is supported thereby and retained in a normal position during walking. NASA

N86-22113*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIRECT MODEL REFERENCE ADAPTIVE CONTROL OF A FLEXIBLE ROBOTIC MANIPULATOR
Deirdre R. Meldrum 15 Dec. 1985 90 p refs
(Contract NAS7-918)
(NASA-CR-176659; JPL-PUB-85-100; NAS 1.26:176659) Avail: NTIS HC A05/MF A01 CSCL 05H

Quick, precise control of a flexible manipulator in a space environment is essential for future Space Station repair and satellite servicing. Numerous control algorithms have proven successful in controlling rigid manipulators wih colocated sensors and actuators; however, few have been tested on a flexible manipulator with noncolocated sensors and actuators. In this thesis, a model reference adaptive control (MRAC) scheme based on command generator tracker theory is designed for a flexible manipulator. Quicker, more precise tracking results are expected over nonadaptive control laws for this MRAC approach. Equations of motion in modal coordinates are derived for a single-link, flexible manipulator with an actuator at the pinned-end and a sensor at the free end. An MRAC is designed with the objective of controlling the torquing actuator so that the tip position follows a trajectory that is prescribed by the reference model. An appealing feature of this direct MRAC law is that it allows the reference model to have fewer states than the plant itself. Direct adaptive control also adjusts the controller parameters directly with knowledge of only the plant output and input signals. Author

N86-22114*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECONFIGURABLE WORK STATION FOR A VIDEO DISPLAY UNIT AND KEYBOARD Patent Application
Nicholas L. Shields (Essex Corp.), Mary F. Fagg (Essex Corp.), David E. Henderson (Essex Corp.), and Fred D. Roe, inventors (to NASA) Filed 5 Dec. 1985 17 p
(NASA-Case-MFS-26009-1SB; NAS 1.71:MFS-26009-1SB; US-Patent-Appl-SN-805011) Avail: NTIS HC A02/MF A01 CSCL 05H

A reconfigurable workstation is illustrated having video, keyboard, and hand operated motion controller capabilities. The workstation includes main side panels between which a primary work panel is pivotally carried in a manner in which primary work panel may be adjusted and set in a negatively declined or positively inclined position for proper forearm support while operating hand controllers. A keyboard table supports a keyboard in such a manner that the keyboard is set in a positively inclined position with respect to the negatively declined work panel. Various adjustable devices are provided for adjusting the relative declinations and inclinations of the work panels, tables, and visual display panels. NASA

N86-22115# New Mexico State Univ., Las Cruces. Behavioral Engineering Lab.
A MULTIPLE-REGRESSION MODEL OF PILOT PERFORMANCE IN VERTICAL AND TRANSLATIONAL FLIGHT
John Wiedemann and Stanley N. Roscoe May 1985 102 p
(Contract N00014-81-K-0439)
(AD-A161364; BEL-85-2/ONR-85-2) Avail: NTIS HC A06/MF A01 CSCL 01/4

An experiment was conducted to advance the development of a multiple regression model of VTOL pilot performance as a function of various control/display system and flight mission variables. Second-order response surfaces as a function of two control system design variables (translational control order and

vertical control gain reduction factor) and three downward-looking display design variables (horizontal position error magnification, translational prediction time, and translational tracking mode) were derived from Pilot performances on each of three mission scenarios. The optimum values for each of the five system design variables were determined for each scenario independently using the same central composite experimental design with three groups of four subjects each. Comprehensive analyses of variance and canonical analyses were used to refine the fitted surfaces to determine the true nature of the pilot performance effects for each flight scenario and to select a single set of system design parameters that would yield near-optimum performances on all three scenarios. GRA

N86-22116# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
EVALUATION OF A PASSENGER MASK MODIFIED WITH A REBREATHER BAG FOR PROTECTION FROM SMOKE AND FUMES
E. A. Higgins, J. T. Saldivar, P. J. Lyne, and G. E. Funkhouser Oct. 1985 25 p
(AD-A162473; DOT/FAA/AM-85-10) Avail: NTIS HC A02/MF A01 CSCL 06/11

A series of experiments were conducted in an altitude chamber at ground level, 8,000 ft, 14,000 ft, and 21,500 ft, both with and without exercise, to evaluate the potential for providing protection from smoke and fumes for airline passengers while wearing a standard continuous-flow passenger mask modified by the addition of a rebreather bag. It was determined that it would provide increased protection for those individuals who had tidal volumes of 1.5 L or less. However, it would not function properly for those individuals who had tidal volumes greater than 1.5 L. Either the carbon dioxide levels were too great (above 15 mm Hg partial pressure) or the rebreather bag collapsed. These results indicate that the addition of the rebreather bag to the passenger mask has the potential for providing protection from smoke and fumes, but the system must have appropriately balanced valve resistances and appropriately sized valve openings. This critical balance has not yet been achieved for those individuals with large tidal volumes. GRA

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N86-22117# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
CWI NEWSLETTER, NO. 2, MARCH 1984
Arjeh M. Cohen, ed., Richard D. Gill, ed., and Jan Heering, ed. Mar. 1984 51 p refs
(CWI-Newsletter-2; ISSN-0168-826X) Avail: NTIS HC A04/MF A01

The proof of two properties of the subjects of positive integers (Van den Waerden's Theorem and Hindeman's Theorem) by use of dynamical topology is reported. A mathematical approach to software problems is discussed. Numerical research on the Riemann hypothesis is presented. For individual titles, see N86-22118 through N86-22120.

N86-22118# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
TWO APPLICATIONS OF TOPOLOGICAL DYNAMICS IN COMBINATORIAL NUMBER THEORY **c64**
Jan deVries *In its* CWI Newsletter, No. 2, March 1984 Mar. 1984 p 2-17 refs (For primary document see N86-22117 12-59)
Avail: NTIS HC A04/MF A01

Methods of dynamical topology are reported. A theorem of Van der Waerden and a theorem of Hindeman are proved using dynamical topology methods. Results concern combinatorial number theory. Author (ESA)

N86-22119# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
SOFTWARE DEVELOPMENT: SCIENCE OR PATCHWORK **c61**
Robert L. Baber *In its* CWI Newsletter, No. 2, March 1984 Mar. 1984 p 18-34 refs (For primary document see N86-22117 12-59)
Avail: NTIS HC A04/MF A01

A series of case examples illustrates the problematic state of affairs in the field of software development theory. Detailed specifications and design and development of computer software in various technical and scientific domains are discussed. Author (ESA)

N86-22120# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
RECENT PROGRESS ON THE NUMERICAL VERIFICATION OF THE RIEMANN HYPOTHESIS **c67**
J. vandeLune and H. J. J. teRiele *In its* CWI Newsletter, No. 2, March 1984 Mar. 1984 p 35-37 refs (For primary document see N86-22117 12-59)
Avail: NTIS HC A04/MF A01

The fact that the first 400 million nontrivial zeros of Riemann's zeta function are all simple and are on the critical line is reported. Author (ESA)

N86-22121# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
CWI NEWSLETTER, NO. 7, JUNE 1985
Arjeh M. Cohen, ed., Richard D. Gill, ed., and Jo C. Ebergen, ed. Jun. 1985 46 p refs
(CWI-Newsletter-7; ISSN-0168-826X) Avail: NTIS HC A03/MF A01

Second order approximation concerning the deficiency theory is discussed. Three classic problems are discussed by use of set theory and topology. A problem of optimization methods (Vehicle Routing Problem) for distribution management is studied. A bibliography of UNIX and C Language is given. For individual titles, see N86-22122 through N86-22124.

N86-22122# Limburg State Univ., Maastricht (Netherlands).
SECOND ORDER APPROXIMATIONS **c64**
Willem Albers *In* CWI CWI Newsletter, No. 7, June 1985 Jun. 1985 p 2-7 (For primary document see N86-22121 12-59)
Avail: NTIS HC A03/MF A01

Aspects of the second order approximation are discussed. Hodger-Lehmam's deficiency theory is presented with practical examples. Author (ESA)

N86-22123# Amsterdam Univ. (Netherlands).
SET THEORY AND TOPOLOGY **c67**
Jan vanMill *In* CWI CWI Newsletter, No. 7, June 1985 Jun. 1985 p 10-14 refs (For primary document see N86-22121 12-59)
Avail: NTIS HC A03/MF A01

The methods of set theory and topology are discussed using three classical problems. The fact that Alexandroff's problem is undecidable is reported. The fact that the Whitehead's problem is not undecidable by consideration of the Martin's axiom but, not the continuum hypotheses, is conjectured. The fact that the Choquet problem can be studied as a topological problem is shown. Author (ESA)

N86-22124# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
VEHICLE ROUTING AND COMPUTER GRAPHICS **c61**
M. W. P. Savelsbergh *In its* CWI Newsletter, No. 7, June 1985

Jun. 1985 p 15-24 refs (For primary document see N86-22121 12-59)
(Grant STW-CWI-22-0348)
Avail: NTIS HC A03/MF A01

The vehicle routing problem as a optimization method for distribution management is studied. Arguments for interactive approaches to computerized vehicle routing are proposed.

Author (ESA)

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N86-22125 Pennsylvania State Univ., University Park.
COLOR IMAGE PROCESSING WITH COMPUTER-GENERATED SPATIAL FILTERS IN A DISPERSED WHITE-LIGHT OPTICAL SYSTEM Ph.D. Thesis
Michael Stanley Dymek 1985 173 p
Avail: Univ. Microfilms Order No. DA8518018

Computer generated (CG) spatial filters are applied to color image processing in a dispersed white light optical system. The range of input wavelengths produces continuously dispersed Fourier spectra in the filter plane, each having scale factor proportional to wavelength. Analysis of the requirements for multi-, discrete-band filters to achieve real bipolar and complex filtering operations on the dispersed color spectra is presented. Computer simulations, for the linear image deblurring example, show that significant processing performance can be achieved by filters realized with typical CG filter making devices. Processing performance is more sensitive to filter geometry and alignment for the color processor than for a monochromatic processor, primarily because of color smear effects, similar to those produced with holograms under white light illumination. Experimental results with binary and continuous tone smeared color images agree well with computer simulation results. Wavelength discrimination in the color image display material largely determines the effectiveness of wavelength as an additional degree of freedom in an optical processing system. Finally, a parallel processing technique is proposed which can increase the number of CG filter processing channels for moderate resolution color input images.

Dissert. Abstr.

N86-22126 Stanford Univ., Calif.
PARALLEL ARCHITECTURES FOR COMPUTER GRAPHICS DISPLAYS Ph.D. Thesis
Marc Regis Hannah 1985 121 p
Avail: Univ. Microfilms Order No. DA8522154

The use of Very Large Scale Integration (VLSI) based parallel architectures in two aspects of computer graphics display hardware was investigated. First, a flexible multiprocessor pipeline architecture for geometric computation is described. Second, the architecture and algorithms of a distributed processing array for smooth-shaded scan-conversion of three dimensional geometric image descriptions is presented. Frame buffers driving raster-scanned displays have recently become the technology of choice for computer graphics because of their flexibility and relatively low cost. Two graphics methodologies have evolved for programming these displays (bit-map and geometric). Geometric graphics, although more convenient from the user's standpoint, has previously required expensive hardware support to avoid slow system response. The Geometry Engine is a low cost, VLSI based architecture for providing the hardware support necessary for interactive geometric graphics. This work extends the Geometry Engine architecture to support smooth-shaded rendering, and higher performance systems.

Dissert. Abstr.

N86-22127 Stanford Univ., Calif.
ARCHITECTURAL ELEMENTS FOR BITMAP GRAPHICS Ph.D. Thesis
Cary Dikel Kornfeld 1985 135 p
Avail: Univ. Microfilms Order No. DA8522176

Two closely related aspects of bitmap graphics methods for manipulating bitmap images and techniques for displaying these images are examined. The implementation of three primitive operations useful when manipulating images are presented in Mirror, Rotate and Translate (BitBlt). When implemented on conventional bitmap systems these fundamental operations require extensive memory and processor activity. Alternative architectures for bitmap graphic systems are explored. Two architectural elements that significantly improve system performance are defined. The first, a Raster Op unit, combines four bitmap images under arbitrary merging operations at video data rates. The second element, called an Image Prism, generates orthogonal image transformations on bitmap images without requiring processor interaction. As a result, these fundamental operations can be performed several hundred times faster than before. VLSI implementations of each are described and their performance is reviewed. The design and development of a research display device is presented. Three major architectural components of traditional CRT-based bitmap display systems (frame buffer, display controller and display device are interated into a single, exceptionally thin, flat display device of which several working prototypes were built.

Dissert. Abstr.

N86-22128 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A PROTECTION MODEL FOR DISTRIBUTED DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
Atika Laribi 1985 267 p
Avail: Univ. Microfilms Order No. DA8521333

Security is important for Centralized Data Base Management Systems (CDBMS) and becomes crucial for Distributed Data Base Management Systems (DDBMS) when different organizations share information. Secure cooperation can be achieved only if each participating organization is assured that the data it makes available will not be abused by other users. Differences between CDBMS and DDBMS that characterize the nature of the protection problem in DDBMS are identified. These differences are translated into basic protection requirements. Policies that a distributed data base management protection system should allow are described. The hybrid system is incorporated in a general model of DDBMS protection. Three levels of abstraction describing different apects of DDBMS protection problems are defined. The conceptual level describes the protection control of the DDBMS transactions and information flows. The logical level is concerned with the interaction between the different organizations participating in the DDBMS. The physical level is involved with the architectural implementation of the logical level.

Dissert. Abstr.

N86-22129*# Allied Bendix Aerospace, Mishawaka, Ind. Guidance Systems Div.
HARDWARE TEST PROGRAM FOR EVALUATION OF BASELINE RANGE/RANGE RATE SENSOR CONCEPT
E. Pernic Dec. 1985 127 p
(Contract NAS8-36144)
(NASA-CR-178710; NAS 1.26:178710; BGSD-MO-7078) Avail: NTIS HC A07/MF A01 CSCL 09B

The test program Phase II effort provides additional design information in terms of range and range rate (R/R) sensor performance when observing and tracking a typical spacecraft target. The target used in the test program was a one-third scale model of the Hubble Space Telescope (HST) available at the MSFC test site where the tests were performed. A modified Bendix millimeter wave radar served as the R/R sensor test bed for evaluation of range and range rate tracking performance, and generation of radar signature characteristics of the spacecraft target. A summary of program test results and conclusions are presented along with detailed description of the Bendix test bed radar with accompaning instrumentation. The MSFC test site and facilities are described. The test procedures used to establish background levels, and the calibration procedures used in the range accuracy tests and RCS (radar cross section) signature

measurements, are presented and a condensed version of the daily log kept during the 5 September through 17 September test period is also presented. The test program results are given starting with the RCS signature measurements, then continuing with range measurement accuracy test results and finally the range and range rate tracking accuracy test results. Author

N86-22130*# California Inst. of Tech., Pasadena.
ADVANCED TECHNOLOGY UNIT TRAINING AND MANAGEMENT SYSTEM (ATUTMS). USER'S GUIDE Final Report, Jan. 1984 - Jun. 1985
T. Antczak, A. Benson, and T. Ibbott 14 Jul. 1985 319 p
(Contract NAS7-918)
(NASA-CR-176643; NAS 1.26:17643; AD-A161002; ARI-RN-85-71) Avail: NTIS HC A14/MF A01 CSCL 05/9

A computer-based management information system was designed to assist unit training at the battalion level. A prototype system was successfully implemented and made operational within a host battalion of the U.S. Army personnel in the use of this system. ATUTMS uses the relational database management system, INGRES, to record information and to produce reports needed for battalion management. INGRES is utilized to store, add, change, and delete data, and to generate reports. The relational database includes the three functional areas of the battalion: Personnel, Training and Logistics. Word processing is accomplished on ATUTMS by using a software program called MUSE. MUSE consists of a powerful text editor, a spelling checker, and the capability to print documents on either a dot-matrix printer or the system letter-quality printer. Useful tools available on the ATUTMS computer system, in addition to the database management system and word processing, are MAIL and PHONE. Using these tools, the user can communicate with other users on-line or send messages to be read later. The ATUTMS hardware is based on a central computer located in the battalion headquarters building. Terminals are distributed throughout the battalion facilities to make them easily available to users. The central computer is a VAX 11/750. GRA

N86-22131# Naval Ocean Systems Center, San Diego, Calif.
ADVANCED MAIL SYSTEMS TECHNOLOGY. EXECUTIVE SUMMARY AND APPENDICES A-G Annual Report, 1 Sep. 1983 - 31 Aug. 1984
Nov. 1984 139 p
(AD-A161003; NOSC/TR-1038; AR-9) Avail: NTIS HC A07/MF A01 CSCL 09/2

The principal objectives of this work are to provide for the US Postal Service improvements in image acquisition, compression, storage and presentation technology. Contents includes: graphics conversion subsystem hardware and software; datacopy camera as the graphics conversion system input; graphics conversion acquisition alternatives; illumination computation program; an autoedit program; thinning algorithm; examples of facsimile data compression. GRA

N86-22132# Illinois Univ., Urbana. Applied Computation Theory Group.
A UNIFIED APPROACH TO THE ANALYSIS AND SYNTHESIS OF SYSTOLIC ARRAYS M.S. Thesis
Scot W. Hornick Apr. 1985 50 p
(Contract N00014-84-C-0149)
(AD-A161326; ACT-56; UILU-ENG-85-2214) Avail: NTIS HC A03/MF A01 CSCL 09/2

The first steps toward the development of a theoretical framework to unify the analysis and synthesis of systolic networks are taken. A class of transformations on systolic networks is described that alter the topology of a network while preserving the timing of its computations. These transformations may be used to demonstrate the equivalence of two existing systolic designs or to obtain a new design from an existing one, according to particular design specifications. A model of systolic network is presented and then the parameters that are used to characterize one are identified. Next, the correctness of two types of transformations on these parameters is proved. These transformations are shown to account for different processor types and multiple processor states. Finally, these transformations characterize those that avoid the phenomenon of crossing. Author (GRA)

N86-22133# Illinois Univ., Urbana. Coordinated Science Lab.
SPECIAL PURPOSE COMPUTER ARCHITECTURE FOR LU FACTORIZATION OF PARTITIONED SYSTEMS Final Technical Report, Aug. 1983 - Aug. 1984
Kin-Man I. Lui Aug. 1985 98 p
(Contract N00014-84-C-0149)
(AD-A161351; R-1015; UILU-ENG-84-2209) Avail: NTIS HC A05/MF A01 CSCL 09/2

The simulation of large-scale integrated circuits requires a considerable amount of computation time using the currently available circuit simulation programs like SPICE. One of the bottlenecks of these simulation programs is in solving these systems of linear equations using LU factorization. The idea of a nested clustering algorithm to partition the matrices into bordered block diagonal form to facilitate parallel processing is explored. In addition, an architecture combining both the systolic array and the wavefront array processors is proposed to perform the LU factorization of the partitioned system using highly concurrent parallel processor arrays. Author (GRA)

N86-22134# Naval Postgraduate School, Monterey, Calif.
A DECISION SUPPORT SYSTEM FOR COST-EFFECTIVENESS ANALYSIS FOR CONTROL AND SECURITY OF COMPUTER SYSTEMS M.S. Thesis
Emmanuel A. Prevenas Sep. 1985 152 p
(AD-A161388) Avail: NTIS HC A08/MF A01 CSCL 09/2

The increasing number of computer failures and crimes has forced managers to tighten the control procedures of their EDP systems. However, the cost of an exhaustive control strategy is often very expensive, and its effectiveness is not guaranteed. This thesis designs and implements a Decision Support System that helps determine optimal control procedures for EDP systems (CEA-DSS). The model base of the proposed DSS consists of various techniques for estimating computer exposures. The latter can be interactively analyzed via a Dialogue interface that supports tabular and graphic outputs. CEA-DSS also provides extensive database management capabilities to keep track of the diverse control problems. It is implemented in PASCAL for the IBM-PC. GRA

N86-22135# Florida State Univ., Tallahassee. Dept. of Statistics.
OPTIMUM ALLOCATION IN MULTISTATE SYSTEMS, WITH APPLICATIONS IN RELIABILITY
E. El-Neweihi, F. Proschan, and J. Sethuraman May 1985 9 p
(Contracts DAAG29-82-K-0168; F49620-85-C-0007)
(AD-A161392; FSU-STATISTICS-M699; TR-85-175-AFOSR; ARO-19367.28-MA; TR-D-80-ARO) Avail: NTIS HC A02/MF A01 CSCL 14/4

This paper presents some results in the optimal allocation of multistate components in a parallel-series system. In addition, these results may be used to obtain fruitful applications in reliability theory. Our basic mathematical tools are majorization and Schur functions; the theorems obtained and methods used are related to those of Optimal Allocation of Components in Parallel-Series and Series-Parallel systems. The present paper and the reference just above are the only papers exploiting the elegance and power of majorization and Schur functions to solve optimal allocation problems in reliability. GRA

N86-22136# Illinois Univ., Urbana. Applied Computation Theory Group.
DICTIONARY MACHINES FOR CUBE-CLASS NETWORKS
Alan M. Schwartz 5 Apr. 1985 75 p
(Contract N00014-84-C-0149)
(AD-A161393; ACT-53; IU-UILU-ENG-85-2206; R-1031) Avail: NTIS HC A04/MF A01 CSCL 05/2

A dictionary is a data structure that supports insertion, deletion, and retrieval operations. To maintain a database, a dictionary

machine accepts an arbitrary sequence of instructions at a constant rate. This idea presents two new VLSI dictionary machines on networks that emulate the binary cube. One machine runs on a shuffle-exchange network. The other machine runs on a cube-connected cycles network. These two designs demonstrate that general purpose networks can perform dictionary operations. Chapter 1 includes a definition of the dictionary machine problem and an overview of previous work. Chapters 2 and 3 present the bulk of this idea: two dictionary algorithms that run on cube-class architectures. The design in Chapter 2 uses bitonic merge to perform dictionary operations on the SEN. It also presents a novel architecture to implement pipelining. This architecture is an important contribution. The dictionary algorithm of Chapter 3 runs on the CCC and borrows heavily from previous work on three machines. Chapter 4 places these new designs in perspective with previous work and offers concluding remarks. GRA

N86-22137# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
DECISION SUPPORT SYSTEM FOR ASD (AERONAUTICAL SYSTEMS DIVISION) PROGRAM MANAGERS M.S. Thesis
Terrence W. Brotherton Sep. 1985 180 p
(AD-A161690; AFIT/GSM/LSY/85S-5) Avail: NTIS HC A09/MF A01 CSCL 09/2

This thesis effort identifies the program management tasks most amenable to computerization, researches existing implementation of the identified tasks, and incorporated selected implementations with a user friendly interface on a Zenith Z-100 computer. The thesis is a combination of reviewed literature and the demonstration of the prototype concept. The literature review concentrated on the program management environment, the application of a Decision Support System (DSS) to that environment, Information System design factors related to development of a DSS and the evaluation of Information systems. A prototyping effort ensued to insure that the system would meet the requirements of the prototype user. The DSS prototype was demonstrated to two sub-groups of generic program managers at ASD and AFIT. Using a developed evaluation instrument, they evaluated eleven qualities of the DSS. The evaluation was composed of the three subcategories of system worth, system quality, and user propensity to use the system. The DSS was favorably received by both groups of prospective users. GRA

N86-22138# Columbia Univ., New York. Library.
ALGORITHMS FOR NONLINEAR PROGRAMMING Final Report, 15 Aug. 1983 - 31 May 1985
Donald Goldfarb 30 Jul. 1985 7 p
(Contract DAAG29-82-K-0106)
(AD-A161746; Rept-85-1; ARO-21013.5-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several algorithms for solving problems in linear, quadratic, and nonlinear programming, network flows, and facilities location were developed and analyzed. Results include: (1) The analysis of the computational complexity of the problem of determining an optimally sparse representation of the null space of a matrix, and the development of worst-case bounds for the shadow-vertex simplex algorithm and several heuristics for distance constrained discrete facility location problems and conditional covering problems; (2) The development of efficient algorithms for dense and sparse assignment problems, strictly convex quadratic programming problems, and a nonlinear programming problem that arises when maximizing a correlation coefficient subject to linear constraints; and (3) The application of iterative methods to large sparse equality-constraind quadratic programs and the development of multiple constraint deletion strategies for active-set algorithms for linearly constrained nonlinear programming problems. Author (GRA)

N86-22139# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
DP FORMAT OF THE DRAWING FILES Interim Report
Dario Giuse Sep. 1985 27 p
(AD-A162440; CMU-RI-TR-85-16) Avail: NTIS HC A03/MF A01 CSCL 09/2

DP is a highly interactive graphics editor that runs on a personal workstation and can produce general-purpose illustrations as well as circuit drawings. The main purpose of this document, which is a complete specification of the format and semantics of DP drawing files, is to encourage the development of application programs that can read and generate drawings in the DP format and thus exchange information in graphic form. GRA

N86-22140# Illinois Univ., Urbana. Coordinated Science Lab.
A PARALLEL STACK PROCESSOR TO REDUCE PROCEDURE-CALL OVERHEAD M.S. Thesis
Richard J. Eickemeyer Nov. 1985 83 p
(Contracts N00039-80-C-0556; N00014-84-C-0149)
(AD-A162494; UILU-ENG-85-2232; CSG-48) Avail: NTIS HC A05/MF A01 CSCL 09/2

A processor organization is presented to reduce the large overhead of procedure calls in high-level languages. In the Parallel Stack Processor, processor registers are each at the top of a hardware stack of registers. Saving processor registers on procedure call takes place in one cycle by pushing all registers simultaneously. A detailed performance model, driven by dynamic high-level language statistics, is presented. Results from the model indicate the effect on performance of the parallel stack computer architecture when compared to a processor without parallel stacks. The processor architecture is specified in the report along with a discussion of implementation details for the VLSI single-chip processor. Author (GRA)

N86-22141# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
GEONAMES PROCESSING SYSTEM FUNCTIONAL DESIGN SPECIFICATION. VOLUME 5: PERFORMANCE SPECIFICATIONS Final Report
Gail Langran Mar. 1985 32 p
(AD-A162571; AD-E900528; NORDA-102-Vol-5) Avail: NTIS HC A03/MF A01 CSCL 05/2

This work, referred to as the Geonames Processing System, will be conducted during FY82-FY89. A Comprehensive Coordination Plan (Norda Technical Note 189) was written in FY82 to provide a general system description. The Geonames Processing System Functional Design Specification, of which this is Volme 5, describes in more detail a proposed system based on requirements presented to NORDA by DMA Headquarters and DMA's two production centers. A comprehensive system with simple and adaptable standard interfaces is described. This volume outlines the performance specifications of the Geonames Processing System as a whole. Stated requirements are either shared by all four subsystems, or are developmental functions. GRA

N86-22142# Illinois Univ., Urbana. Coordinated Science Lab.
SIMULATIONS AMONG MULTIDIMENSIONAL ITERATIVE ARRAYS, ITERATIVE TREE AUTOMATA, AND ALTERNATING TURNING MACHINES M.S. Thesis
Jerry L. Trahan Jan. 1986 42 p
(AD-A162661; IU-UILU-ENG-86-2202; ACT-66) Avail: NTIS HC A03/MF A01 CSCL 12/1

We present three simulations: a simulation of an alternating Turning machine (ATM) operating in time T(n) by an iterative tree automation (IITA), a simulation of a d-dimensional iterative array (dIA) operating in time T(n) by an ATM and a simulation of an ITA operating in time T(n) by an ATM. The first two improve previously known results. The first implies the simulation of a nondeterministic Turing machine by an ITA in time O(T(n)) of Culik and Yu(1984)sub d + 1. The second is stronger than the simulation of a dIA by an ATM in time O((T(n)) /logT(n)) of Seiferas (1977) and Dymond and Tompa (1985). GRA

N86-22143# Oak Ridge National Lab., Tenn.
EFFICIENT PARALLEL LU FACTORIZATION WITH PIVOTING ON A HYPERCUBE MULTIPROCESSOR
G. A. Geist Oct. 1985 28 p
(Contract DE-AC05-84OR-21400)

(DE86-001461; ORNL-6211) Avail: NTIS HC A03/MF A01

A message-passing parallel algorithm is developed for forming the LU factors of general non-singular matrices on a hypercube multiprocessor. Partial pivoting is performed to ensure numerical stability, but the scheduling of tasks is such that the pivot search in the parallel algorithm is completely masked. Empirical tests show that the load imbalance produced by random pivoting causes a 5% to 14% increase in execution time. A complementary parallel triangular solution algorithm is also given. Comparisons with the non-pivoting case are used to demonstrate the efficiency of this new algorithm. DOE

N86-21938*# Space Development Corp., Hampton, Va.
DATA REDUCTION, MANAGEMENT, AND ANALYSIS SOFTWARE FOR CID
Charles W. Davis *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 61-77 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 20K

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-22144 Oregon State Univ., Corvallis.
VIEW BASED, GLOBAL DESIGN OF ACCESS STRUCTURES FOR RELATIONAL DATABASES Ph.D. Thesis
Taflan Imre Gundem 1985 184 p
Avail: Univ. Microfilms Order No. DA8523617

The problem of automating the design of access structures for relational database systems is considered. The main considerations are effective and rigorous utilization of the users' usage patterns, global treatment of the whole design and utilizing most of the commonly known access structures. The usage patterns are represented on the access structures as relational algebra views. A view into one or more simple access structures is transformed. Using the simple access structures compound access structures were generated. For this set of access structures an approximately optimal set of access structures was chosen that process the input views as efficiently as possible and obey the storage space constraint. In developing the transformation methods, concepts of aggregation and generalization for access structure were developed and use in obtaining compound access structures from simple data items and in integrating several access structures into one access structure. A general method was introduced that shows how any complex access structure is formed from the simple data items using aggregation. Dissert. Abstr.

N86-22145 California Inst. of Tech., Pasadena.
COMBINING COMPUTATION WITH GEOMETRY Ph.D. Thesis
Sheue-Ling Chang Lien 1985 185 p
Avail: Univ. Microfilms Order No. DA8522623

Mathematical principles are sought to provide efficient solutions to various time consuming operations in computer aided geometric design. Three major topics are discussed: design validation by means of object interference detection, object reconstruction through the union, intersection, and subtraction of two polyhedra, and calculation of basic engineering properties such as volume, center of mass, or moments of inertia. Two criteria are presented for solving the problems of point polygon enclosure and point polyhedron enclosure in object interference detection. An algorithm for efficient point polyhedron enclosure detection is presented. Singularities encountered in point polyhedron enclosure detection are categorized and simple methods for resolving them are also included. A new scheme for representing solid objects, called skeletal polyhedron representation, is proposed. Also included are algorithms for performing set operations on polyhedra (or polygons) represented in skeletal polyhedron representation, algorithms for performing edge-edge intersection and face-face intersection in a set operation, and a perturbation method which can be used to resolve singularities for an easy execution of edge-edge intersection and face-face intersection. Dissert. Abstr.

N86-22146 State Univ. of New York, Binghamton.
FUNCTIONAL TEST GENERATION OF DIGITAL LSI/VLSI SYSTEMS USING MACHINE SYMBOLIC EXECUTION TECHNIQUE Ph.D. Thesis
tonysheng Lin 1985 322 p
Avail: Univ. Microfilms Order No. DA8521037

In this dissertation, a functional test pattern generation algorithm is developed. This algorithm is explicit, systematic and practical. The whole research work consists of five related topics including theoretical development and computer experiment. First, a register transfer language specially designed for the functional description of a general digital system is defined. Second, a register-transfer (RT) level fault model quite different from the conventional gate-level stuck-at fault model is established and the fault collapsing analysis is performed for better test generation efficiency. Third, the technique of register-transfer-level symbolic execution is explored. The major problems are defined, analyzed, and solved. A register-transfer-level symbolic execution system is designed and implemented. Fourth, an overall RT-level test pattern generation algorithm is developed based on the RT-level fault model and the RT-level symbolic execution technique. The symbolic executions are performed on both fault-free and fault-injected machines for symbolic results. Dissert. Abstr.

N86-22147 George Washington Univ., Washington, D.C.
A GRAPHICAL DEBUGGER FOR CONCURRENT Ada PROGRAMS Ph.D. Thesis
Melinda Lee Moran 1985 398 p
Avail: Univ. Microfilms Order No. DA8522366

The nature of this research was the design and evaluation of a debugging tool for concurrent Ada programs which employs a graphical abstraction of the task and the rendezvous construct. This graphical debugger was experimentally evaluated against a debugger producing textual output. Sixteen subjects participated in debugging four concurrent Ada programs, two utilizing the graphical debugger and two utilizing the textual debugger. The programs were run on a DEC GIGI terminal tied to a VAX 11/780 under Telesoft's partial Ada compiler. Results of the evaluation indicate that the debugger format effects no statistically significant difference in the mean debugging time required by subjects for programs where (1) the number of tasks in the program is small (four to five) and the relationships between them is simple, (2) the bug in the program is relatively simple, and (3) the bug in the program occurs early in the sequence of events occurring within the program. The evaluation also shows, however, that in terms of subject preference there is a 3:1 difference in favor of the graphical debugger. Dissert. Abstr.

N86-22148 California Inst. of Tech., Pasadena.
HIERARCHICAL COMPOSITION OF VLSI CIRCUITS Ph.D. Thesis
Telle Elizabeth Whitney 1985 146 p
Avail: Univ. Microfilms Order No. DA8522636

A transistor level representation for VLSI circuits is presented. A transistor level cell is represented as the interconnection of devices along with their types, sizes and placement, and the cell's typed ports. Connection is represented explicity by shared connection points. The ports describe the interface between this cell and other cells. This representation, together with a set of synthesis and analysis rules, enforces the description of strictly legal designs. The synthesis rules ensure that each structure is correct by construction. The analysis rules check for geometrical design rule violations which cannot, by their nature be enforced by construction. A file of technology dependent information indicates how to implement each transistor type, interconnect type and connection point type, as well as how structure types may interact. Cells described in this representation may be composed hierarchically to form larger cells. Given and valid composition, the topology, geometry and connectivity of the composite structure

is guaranteed to be legal. A working system supporting this hierarchical representation is also described. Dissert. Abstr.

N86-22149 California Inst. of Tech., Pasadena.
ANIMAC: A MULTIPROCESSOR ARCHITECTURE FOR REAL TIME COMPUTER ANIMATION Ph.D. Thesis
Daniel S. Whelan 1985 299 p
Avail: Univ. Microfilms Order No. DA8522635

This thesis proposes a new architecture for real-time animation engines. The ANIMAC architecture achieves high performance by utilizing a two-dimensional array of processors that determine visible surfaces in parallel. An array of sixteen processors with only nearest neighbor interprocessor communications can produce real-time shadowed images of scenes containing 100,000 triangles. The ANIMAC architecture is based upon analysis and simulations of various parallelization techniques. These simulations suggest that the viewing space be spatially subdivided and that each processor produce a visible surface image for several viewing space subvolumes. Simple assignments of viewing space subvolumes to processors are shown to offer high parallel efficiencies. Simulations of parallel algorithms were driven with data derived from real scenes since analysis of scene composition suggested that using simplistic models of scene composition might lead to incorrect results. Dissert. Abstr.

N86-22150*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPUTER PROGRAM TO CALCULATE THE RESISTIVITY OF A THIN FILM DEPOSITED ON A CONDUCTIVE SUBSTRATE FROM FOUR-POINT PROBE MEASUREMENTS
Lawrence G. Oberle and Gustave C. Fralick Mar. 1986 28 p refs
(NASA-TM-87262; E-2954-NAS 1.15:87262) Avail: NTIS HC A03/MF A01 CSCL 09B

A series of FORTRAN-77 programs is described which correct for the effect of a conducting substrate when a linear four-point probe is used to measure the resistivity of a thin film. The resistiyity of the film is given in terms of the thicknesses of the film and substrate, the known resistivity of the substrate, and the measured delta V/I. A full development is given as well as a complete description of the operation of the programs. The programs themselves can be obtained through COSMIC, and are identified as LEW No. 14381. Author

N86-22151*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SIMRAND 1 COMPUTER PROGRAM: SIMULATION OF RESEARCH AND DEVELOPMENT PROJECTS
R. F. Miles, Jr. 15 Feb. 1986 79 p refs
(JPL Proj. 5101-274; Contract DE-AI01-85CE-89008)
(NASA-CR-176665; JPL-PUB-85-96; DOE/JPL-1012-115; NAS 1.26:176665) Avail: NTIS HC A05/MF A01 CSCL 09B

The SIMRAND I Computer Program (Version 5.0 x 0.3) written in Microsoft FORTRAN for the IBM PC microcomputer and its compatibles is described. The SIMRAND I Computer Program comprises eleven modules-a main routine and ten subroutines. Two additional files are used at compile time; one inserts the system or task equations into the source code, while the other inserts the dimension statements and common blocks. The SIMRAND I Computer Program can be run on most microcomputers or mainframe computers with only minor modifications to the computer code. Author

N86-22152*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE RANDOM COMPUTER PROGRAM: A LINEAR CONGRUENTIAL RANDOM NUMBER GENERATOR
R. F. Miles, Jr. 15 Feb. 1986 56 p refs
(JPL Proj. 5101-275; Contract DE-AI01-85CE-89008)
(NASA-CR-176664; JPL-PUB-85-97; DOE/JPL-1012-116; NAS 1.26:176664) Avail: NTIS HC A04/MF A01 CSCL 09B

The RANDOM Computer Program is a FORTRAN program for generating random number sequences and testing linear congruential random number generators (LCGs). The linear congruential form of random number generator is discussed, and the selection of parameters of an LCG for a microcomputer described. This document describes the following: (1) The RANDOM Computer Program; (2) RANDOM.MOD, the computer code needed to implement an LCG in a FORTRAN program; and (3) The RANCYCLE and the ARITH Computer Programs that provide computational assistance in the selection of parameters for an LCG. The RANDOM, RANCYCLE, and ARITH Computer Programs are written in Microsoft FORTRAN for the IBM PC microcomputer and its compatibles. With only minor modifications, the RANDOM Computer Program and its LCG can be run on most microcomputers or mainframe computers. Author

N86-22153*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SIMRAND METHODOLOGY: THEORY AND APPLICATION FOR THE SIMULATION OF RESEARCH AND DEVELOPMENT PROJECTS
R. F. Miles, Jr. 15 Feb. 1986 37 p refs
(JPL Proj. 5101-277; Contract DE-AI01-85CE-89008)
(NASA-CR-176663; JPL-PUB-85-98; DOE/JPL-1012-117; NAS 1.26:176663) Avail: NTIS HC A03/MF A01 CSCL 09B

A research and development (R&D) project often involves a number of decisions that must be made concerning which subset of systems or tasks are to be undertaken to achieve the goal of the R&D project. To help in this decision making, SIMRAND (SIMulation of Research ANd Development Projects) is a methodology for the selection of the optimal subset of systems or tasks to be undertaken on an R&D project. Using alternative networks, the SIMRAND methodology models the alternative subsets of systems or tasks under consideration. Each path through an alternative network represents one way of satisfying the project goals. Equations are developed that relate the system or task variables to the measure of reference. Uncertainty is incorporated by treating the variables of the equations probabilistically as random variables, with cumulative distribution functions assessed by technical experts. Analytical techniques of probability theory are used to reduce the complexity of the alternative networks. Cardinal utility functions over the measure of preference are assessed for the decision makers. A run of the SIMRAND Computer I Program combines, in a Monte Carlo simulation model, the network structure, the equations, the cumulative distribution functions, and the utility functions. Author

N86-22154# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
CWI NEWSLETTER, NO. 6, MARCH 1985
Arjeh M. Cohen, ed., Richard D. Gill, ed., and Jo C. Ebergen, ed. Mar. 1985 52 p refs
(CWI-Newsletter-6; ISSN-0168-826X) Avail: NTIS HC A04/MF A01

The Pythagoras tree as a Julia set is described. Activities related to programming in Ada language are presented. For individual titles, see N86-22155 through N86-22156.

N86-22155# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
THE PYTHAGORAS TREE AS A JULIA SET
H. A. Lauwerier *In its* CWI Newsletter, No. 6, March 1985 Mar. 1985 p 2-18 refs Previously announced as N86-15028 (For primary document see N86-22154 12-61)
Avail: NTIS HC A04/MF A01

The Pythagoras tree as a Julia set is studied. The determination of the set of infinitesimally small (the blossom) squares formed in the limit when the construction of the Pythagoras tree is continued indefinitely is considered. The examples given are related to the algebraic functions theory. Author (ESA)

N86-22156# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
MATHEMATICAL LIBRARIES IN Ada
Jan Kok *In its* CWI Newsletter, No. 6, March 1985 Mar. 1985

p 19-25 refs (For primary document see N86-22154 12-61)
Avail: NTIS HC A04/MF A01

A short history of the recent progress of Ada language is reported. The contributions of CWI's activities to the research on Ada are summarized. Author (ESA)

N86-22157# Softech, Inc., Waltham, Mass.
Ada REUSABILITY GUIDELINES Final Report
Christine Ausnit, Christine Braun, Sterling Eanes, John Goodenough, and Richard Simpson Apr. 1985 85 p
(AF Proj. 5720)
(AD-A161259; Rept-3285-2-208/2; ESD-TR-85-142) Avail: NTIS HC A05/MF A01 CSCL 09/2

Reusable software is software that can, with little of no modification, be used in a variety of application systems other than that for which it was originally developed. The Ada language provides many features that support reusability, but reusability can be greatly enhanced if the features are used in certain controlled ways. This report addresses the design, development, documentation, and management issues relating to reusability. GRA

N86-22158# System Development Corp., San Diego, Calif.
INTERACTIVE GRAPHICS UTILITY FOR ARMY NEC (NUMERICAL ELECTROMAGNETICS CODE) AUTOMATION (IGUANA). INSTALLATION GUIDE Final Report, Period Ending May 1985
J. Strauch and S. Thompson Sep. 1985 10 p
(Contract N66001-83-D-0094; CM4-1)
(AD-A161324; NOSC-CR-306) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Interactive Graphics Utility for Army NEC Automation (IGUANA) is a system designed to reduce the time required for antenna model evaluation by providing partial automation to both the data entry and the data display processes. Previously antenna evaluation required a lengthy, tedious, and error-prone process involving manual measurement of three dimensional coordinates of each significant point of the desired input structure from scale drawings (generally only top and side views are available), and manual entry via keyboard. IGUANA automates much of the above described process using a personal computer, a digitizer for input of the model wire end points from the top and side scale drawings, a graphics monitor for the display (including rotation and zooming capabilities) of the input data and resulting structures, a mouse for the editing of the structures, a plotter for the production of a hardcopy of the structure in various stages of completion, a printer for generating a hardcopy of data files to be sent eventually to the selected NEC host computer, and a modem to transfer data to and from the NEC host computer. GRA

N86-22159# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
SELECTION OF A MAN-MODELLING CAD (COMPUTER-AIDED DESIGN)
P. L. Rothwell Sep. 1985 22 p
(AD-A161342; DCIEM-85-C-36) Avail: NTIS HC A02/MF A01 CSCL 09/2

DCEIM has been tasked to review Canadian Forces (CF) aircrew/cockpit compatibility and to make recommendations regarding future aircrew selection standards. Computer man-modelling has been proposed as the method to address the evaluation. In this report, three potential computer-aided design, man-modelling programs (CAR, COMBIMAN and SAMMIE) are evaluated. The ELECTRE multi-criteria decision making process was used to select the most appropriate program. The criteria were based on man-modelling and workspace-modelling features, and the capabilities to address the problems of reach, clearance and vision in aircraft crew stations. The results of the analysis support the recommendation to procure SAMMIE. SAMMIE was also found to be suitable to other work station design applications. GRA

N86-22160# Illinois Univ., Urbana. Coordinated Science Lab.
CLUSTERING ALGORITHMS FOR HIERARCHICAL ROUTING IN NETWORKS
James Rossi Dec. 1984 40 p
(Contract N00014-84-C-0149)
(AD-A161372; R-1025; UILU-ENG-84-2219) Avail: NTIS HC A03/MF A01 CSCL 12/1

A distributed asynchronous algorithm to form overlapping clusters on a network with a dynamic topology is presented. Properties of the algorithm are also presented. It is shown that the algorithm is essentially a distributed implementation of a centralized algorithm. Also, bounds on the number or clusters formed on a network with N nodes is derived. The algorithm (DACA) is then compared with another algorithm (DHCA) for forming overlapping clusters in a dynamic environment. It is shown that in some ways, DACA is better than DHCA. The major disadvantage of DACA is that it passes more bits through the network than DHCA. Which algorithm is better depends on the particular implementation. GRA

N86-22161# Harvard Univ., Cambridge, Mass. Computation Lab.
FAST AND EFFICIENT ALGORITHMS FOR LINEAR PROGRAMMING AND FOR THE LINEAR LEAST SQUARES PROBLEM
Victor Pan and John H. Reif 1985 17 p Presented at the 12th International Symposium, Mathematical Programming, 5-9 Aug. 1985, Boston, Mass.
(Contract N00014-80-C-0647; Grant NSF MCS-82-03232; NSF DCR-85-07573)
(AD-A161391; TR-11-85) Avail: NTIS HC A02/MF A01 CSCL 12/1

We present a new parallel algorithm for computing a least-squares solution to a sparse overdetermined system of linear equations Ax=b such that mXn matrix A is sparse and the graph, G = (V,E), of the matrix H. Our algorithm uses Olog(m+n) log squared s(m+n) steps and < or = s cubed (m+n) processors; it relies on our recent parallel algorithm for solving sparse linear systems. The objective of this paper is to reexamine the time-complexity of the l.l.s.p. and to indicate the possibility of speeding up its solution using the parallel algorithms of PR in brackets. As a major consequence, (which may become decisive for determining the best algorithm for the linear programming problem (l.p.p) at least over some important classes of instances of that problem), we will substantially speed up Karmarkar's algorithm, K, for the l.p.p. because solving the l.l.s.p. constitutes the most costly part of every iteration of that algorithm. A very wide range of applications leads to in particular the acceleration of the simplex algorithms, see C,M, for sparse l.p. problems. Further applications may include several combinatorial computations. In the next section we recall two known representations of the l.l.s.p. using normal equations. In section 3 we reexamine the computational cost of sequential algorithms for l.l.s.p. In section 4 we estimate the cost of performing our parallel algorithm for the same problem. In section 5 we consider one of the major applications of our results, that is, to the acceleration of Karmarkar's algorithm. In Appendix we will briefly comment on the current estimates for the computational cost of solving the l.p.p. GRA

N86-22162# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
ASIM (AUTOMATED INTERACTIVE SIMULATION MODELING SYSTEM) VAX VERSION USER'S MANUAL Final Report
S. Kneeburg Feb. 1985 279 p
(Contract F33615-81-C-5098)
(AD-A161556; ESD-TR-85-127) Avail: NTIS HC A13/MF A01 CSCL 09/2

The Automated Interactive Simulation Modeling System (AISIM) provides the user with the ability to do high level simulation of complex operational and distributed data processing systems. The purpose of this manual is to provide the AISIM user with a comprehensive guide for the use of the AISIM system on a VAX 11/780 computer. This manual is a straightforward reference document for the AISIM user. Chap 1 introduces this document, detailing the organization of this document, the document conventions and applicable documents. Chap 2 is an overview of the concepts used in modeling and simulation of systems using AISIM.

Chap 3 contains a detailed description of the AISIM modeling constructs. Chap 4 describes the interface between the AISIM software and the host computer's time sharing system. Chap 5 through 10 present information of the various system user interface levels, including detailed descriptions of prompts and commands. Chap 11 discusses AISIM simulation results and how to interpret them. Appendix A presents operational procedures and other information which is useful for the user to know but not mandatory for using the system. Appendix B lists simulation error messages with a description of their meaning. Appendix C is a glossary of AISIM terms. Appendix D contains a detailed description of the message routing submodel. The tool is designed for the operations analyst or engineer as a workbench for investigating the impact of system alternatives. GRA

N86-22163# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

A MICROCOMPUTER PROGRAM FOR THE SOLUTION OF LEARNING CURVE COMPUTATIONS M.S. Thesis

Larry D. Hutchison Sep. 1985 119 p

(AD-A161648; AFIT/GSM/LSQ/85S-18) Avail: NTIS HC A06/MF A01 CSCL 09/2

A microcomputer program that solves a variety of learning curve computations is written. Based on a review of historical literature and on interviews conducted with cost and price analysts at Wright-Patterson Air Force Base, Ohio, the program integrates a comprehensive file editor with three learning curve applications. The file editor contains features that allow the user to create, edit and review data files containing up to 50 unit/lots. A curve fitting routine has options for the determination of first unit cost and slope coefficient based on the unit curve or cumulative average formulation using either weighted or ordinary least squares techniques. Another feature of the program allows the user to perform sensitivity analysis by varying the first unit cost and learning curve slope to determine the affect on the cost of future units of production. A new routine, not previously seen in earlier learning curve programs, uses a statistical F test to determine the most appropriate formulation, unit or cumulative average, for a given data file. This BASIC computer program is completely menu driven for ease of use. GRA

N86-22164# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

A GUIDE TO PROMOTE THE USE OF ELECTRONIC SPREADSHEETS AMONG AIR FORCE PERSONNEL M.S. Thesis

John C. Grupe Sep. 1985 145 p

(AD-A161682; AFIT/GSM/LS/85S-16) Avail: NTIS HC A07/MF A01 CSCL 05/3

The object of this thesis was to design an instructional text to enable students at the Air Force Institute of Technology in the School of Systems and Logistics to learn to use the electronic spreadsheet available on the Burroughs microcomputer system. The literature review and findings portion of this thesis are meant to familiarize the many aspects of and functions for electronic spreadsheets. While the tutorial text is for use on the Burroughs microcomputer system, concepts written in the text may be transferrable to other electronic spreadsheets. It is with this additional statement that this thesis may also be helpful to Air Force personnel who operate the Air Force Zenith microcomputer systems. GRA

N86-22165# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

AN ASSESSMENT OF Ada'S SUITABILITY IN GENERAL PURPOSE PROGRAMMING APPLICATIONS M.S. Thesis

Larry D. Cavitt and Anthony A. Panek Sep. 1985 235 p

(AD-A161715; AFIT/GLM/LSM/85S-62) Avail: NTIS HC A11/MF A01 CSCL 09/2

The Ada programming language is the result of a multiyear effort under the sponsorship of the Department of Defense (DOD) to obtain the benefits of a single DOD-wide language for use in embedded computer systems. The language was developed to reduce or eliminate many of the serious and costly problems associated with the development and maintenance of software for embedded systems. This thesis assesses Ada's suitability in simple, non-embedded applications, specifically, numerical computation, simulation, and file processing. FORTRAN and PASCAL programs in these applications were translated into Ada. Comparisons were made between the originals and the translations with regard to lines of source code, transportability, maintainability, readability, execution time, and other finding relevant to the study. The study revealed that while further research is needed, Ada is a powerful programming language suitable for use in these non-embedded applications. GRA

N86-22166# Naval Air Development Center, Warminster, Pa. Systems Directorate.

MINIMIZATION OF A SIX VARIABLE BOOLEAN FUNCTION Final Report

Lorraine M. Koch May 1985 114 p

(AD-A161718; NADC-85135-20) Avail: NTIS HC A06/MF A01 CSCL 09/2

The MINIZE computer program is a minimization model which can be used to aid in the design and optimization of a digital system. An interactive input section allows the user to enter any six variable boolean function. MINIZE will then determine the minimum number of four-input medium-scale integration (MSI) circuits needed to realize that function and output their inputs. The purpose of this paper is to describe the MINIZE program and to provide a user's manual. MINIZE is written in HP Basic for use on a Hewlett-Packard 9845B desktop computer with Advanced Programming capability. Section 2 describes the minimization process, along with the techniques used in the model. An example is presented to illustrate the method. Section 3 is the user's manual for the MINIZE program. This section outlines the inputs, outputs and operating instructions for the model. Section 4 describes the program and each of its subroutines. Appendix A contains flowcharts of these routines. GRA

N86-22167# Essex Corp., Orlando, Fla.

COMPUTER-BASED INSTRUCTION (CBI): CONSIDERATIONS FOR A USER-ORIENTED TECHNOLOGY DATA BASE Final Report, Sep. 1984 - Oct. 1985

Norman E. Lane and Grace P. Waldrop 14 Oct. 1985 112 p

(Contract N62269-83-D-0115)

(AD-A161776; AD-E500731; EOTR-85-5) Avail: NTIS HC A06/MF A01 CSCL 05/9

This report documents 1) an analysis of feasibility and 2) the development of a preliminary structure for a computerized data base on capability and availability of computer-based instruction (CBI) technologies within the Department of Defense (DOD). It concludes that the proposed data base, although logistically complex, can be developed and would be of considerable value in providing ready access to technology information for a variety of DoD users. Rationale for recommendations is based on review and synthesis of the CBI research and development (R&D) literature, structured interviews with a cross-section of potential data base users, and an analysis of existing R&D data bases. This report provides a first step in the data base development process, that of examining the user requirements, issues of importance, and potential development considerations. It also describes the subsequent requirements leading to creation of a user-oriented R&D data base for CBI technology. Author (GRA)

N86-22168# Defense Systems Management School, Fort Belvoir, Va.

ARTIFICIAL INTELLIGENCE AND ITS USE IN COST TYPE ANALYSES WITH AND EXAMPLE IN COST PERFORMANCE MEASUREMENT

Barry Berkowitz 1985 40 p Presented at the Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985

(AD-A161817) Avail: NTIS HC A03/MF A01 CSCL 14/1

With the advent of ARTIFICIAL INTELLIGENCE (AI), we are entering into a new age of man/machine/software combined effectiveness. AIL offers us, not only, user friendly application

packages and interfaces, but a major boost in our effectiveness planes. The user friendliness is one aspect of AI, but there are other elements that make this technology a major extension of the human mind. This paper will explore just two applications and their use in the analysis world. The first aspect examined is: user friendliness. The other aspect discussed is expert systems. GRA

N86-22169# McLean Research Center, Inc., Va.
ENHANCEMENT OF PROJECT PRIORITIZATION GOAL PROGRAMMING FORMULATION AND CODE Final Technical Report, May - Sep. 1985
H. R. Blacksten and Judith H. Podell 27 Sep. 1985 141 p
(Contract DAAK70-84-D-0052)
(AD-A162412) Avail: NTIS HC A07/MF A01 CSCL 09/2

A linear goal programming model (LGPM) used by the Belvoir R&D Center for project prioritization decision support was reviewed and improved in this effort. Improvements included addition of efficient sensitivity analysis capabilities, and elimination of certain programming inefficiencies. As a result, the LGPM runs many times faster than before. General application of the LGPM was reviewed and critiqued. Suggestions for novel approaches to project prioritization decision support were offered. Author (GRA)

N86-22170# Yale Univ., New Haven, Conn. Dept. of Computer Science.
TEMPORAL REASONING AND DEFAULT LOGICS
Steve Hanks and Drew McDermott Oct. 1985 131 p
(Contract N00014-85-K-0301)
(AD-A162447; YALEU/CSD/RR-430) Avail: NTIS HC A07/MF A01 CSCL 05/10

This document presents axioms to represent some simple concepts in temporal reasoning: events occuring at points in time, facts holding true over time, events causing facts to begin, facts causing contradictory facts to cease, and facts tending to remain true unless explicitly forced to cease. To express this last notion the authors couch the axioms in a default logic: they alternatively consider the logics of McDermott and Doyle, of Reiter, and of McCarthy. This document defines precisely (through a computer program and its formal description) the conclusions its authors intend be drawn from these axioms, given a particular temporal state of affairs. They prove, however, that these conclusions are not deductions licensed by any of the above default logics. Further analysis leads to the conclusion that these logics are inherently incapable of representing this particular kind of default reasoning. Author (GRA)

N86-22171# Naval Postgraduate School, Monterey, Calif.
TWO NEW APPROXIMATE SOLUTION TECHNIQUES FOR A MOVING TARGET PROBLEM WHEN SEARCHER MOTION IS CONSTRAINED M.S. Thesis
Metin Sagal Sep. 1985 43 p
(AD-A162491) Avail: NTIS HC A03/MF A01 CSCL 12/1

The objective of this thesis is to develop and test two new approximate solution techniques for a moving target problem in discrete time and space where both the searcher and the target have constraints on their paths. The first technique is an application of the heuristic Local Search Method and the second technique is an application of the Frank-Wolfe Method. The motivation for looking at approximate methods is that the problem is NP-complete and optimal solution techniques become impractical for large size problems. Experiments showed that the Local Search Method approach is an efficient technique for obtaining approximate computation solutions. However, the Frank-Wolfe Method approach does not perform well for the problem. Author (GRA)

N86-22172# Illinois Univ., Urbana. Coordinated Science Lab.
FLOW OPTIMIZATION IN DYNAMIC AND CONTINUOUS NETWORKS Ph.D. Thesis
Richard G. Ogier Nov. 1985 111 p
(Contract N00014-82-K-0359)
(AD-A162493; UILU-ENG-85-2229) Avail: NTIS HC A06/MF A01 CSCL 12/2

The problem studied in this thesis is computing a minimum-delay time-varying routing assignment in a dynamic network where the node demands and link capacities are deterministic functions of time, and where the commodity being routed is represented by continuous variables. A single node is designated to be the destination, and a tau-maximum flow is defined to be a routing assignment which maximizes the amount of commodity reaching the destination before time tau. The key discovery used to solve the problem is that a routing assignment has minimum delay if and only if it is a tau-maximum flow for all tau. When the capacities are constant or piecewise-constant, this discovery and the well-known max-flow min-cut theorem are used to divide the problem into two smaller problems. The result is a polynomial algorithm which finds a minimum-delay routing assignment by solving a series of static maximum-flow problems. In order to apply the above ideas to dynamic networks with continuously varying capacities, a continuous network is defined whose flows and capacities are additive set functions, and a generalization of the max-flow min-cut theorem is proved. An even more general version of this theorem is proved for continuous network models whose capacities are submodular set functions. Various applications are considered, including the finite polymatroid networks of Lawler. GRA

N86-22173# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
GEONAMES PROCESSING SYSTEM FUNCTIONAL DESIGN SPECIFICATION. VOLUME 2: GEOGRAPHIC NAMES DATA BASE Final Report
Gail Langran, Allen Barnes, and Steven Miller Mar. 1985 40 p
(AD-A162504; NORDA-99-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the Geonames Processing System attributes and serves as a basis for understanding between the user and the developer. The subsystems referred to are: Advanced Symbol Processing, Advanced Type Placement, Geographic Names Data Base, and Automated Alphanumeric Data Entry System. A subsystem of the Geonames Processing System, the GNDB will handle the data banking, storage, and retrieval of geonames and their associated attributes in an all-digital environment. This will provide a single, controlled repository for geonames data within DMA and, as part of a computer-assisted cartographic system, will increase production throughput. The file will consist of about 60 million geographic names and their attributes, thus serving both toponymic and cartographic products. The GNDB will receive batch inputs from AADES, and will allow authorized operators to modify the data base from interactive ASP workstations. Data sets will be compiled from the GNDB in support of gazetteer and map production. The GNDB will reside at DMAHTC and all updates will be made by DMAHTC personnel. The GNDB will output Names Data Files to DMAHTC users via terminals and to DMAAC users via batch transmission (e.g., magnetic tape or data line). GRA

N86-22174# Army Construction Engineering Research Lab., Champaign, Ill.
DEVELOPMENT AND USE OF THE LIFE CYCLE COST IN DESIGN COMPUTER PROGRAM (LCCID) Final Report
Linda Lawrie Nov. 1985 104 p
(DA Proj. 4A1-62781-AT-45)
(AD-A162522; CERL-TR-E-85/07) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report documents the development of and provides basic user instructions for a program to perform life cycle cost analysis of new military facilities. The program is easy for personnel who have not had much experience with computers to use. It allows the user to select parameters that best describe his/her design project from a menu of choices. Responses to computer queries can often be answered in one word. The program output can either be displayed on the terminal or printed out as hard copy. The output contains much of the information needed for an economic review of a design. The program is written in FORTRAN 77 and will be made available on the Corps of Engineers' timesharing vendor, on District/Division Harris computers, and on

Intel 8086 compatible microcomputers. The source code will be made available for conversions to other hardware, as well. GRA

N86-22175# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
GEONAMES PROCESSING SYSTEM FUNCTIONAL DESIGN SPECIFICATION. VOLUME 3: ADVANCED TYPE PLACEMENT Final Report
Gail Langran Mar. 1985 64 p
(AD-A162552; NORDA-100-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 05/2

Ths work, referred to as the Geonames Processing System, will be conducted during FY82-FY89. A Comprehensive Coordination Plan (NORDA Technical Note 189) was written in FY82 to provide a general system description. The Geonames Processing System Functional Design Specification, of which this is Volume 3, describes in more detail a proposed system based on requirements presented to NORDA by DMA headquarters and DMA's two production centers. A comprehensive system with simple and adaptable standard interfaces is described. This report states the functional, requirements and specifications of a digital type placement system for map names layout, to include names compilation, type composition, and label placement. Section 1 is a subsystem overview. Sections 2-9 discuss major functions. Section 10 shows processing flow. Data set usage is in Section 11; interfaces between the four geonames processing subsystems are in Section 12. Assumptions and constraints on which the design is based are in Section 13. Hardware and performance requirements are in Sections 14 and 15, respectively. Digital type placement will provide DMA with a softcopy method of type placement that exploits a digital Geonames Data Base and will integrate map/chart names overlay production into overall digital chart production. GRA

N86-22176# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
THE USE OF QUANTITATIVE DATABASES IN ALADIN, AN ALLOY DESIGN SYSTEM Interim Report
Ingemar Hulthage, Michael D. Rychener, Mark S. Fox, and Martha L. Farinacci Sep. 1985 18 p Sponsored in part by Alcoa Labs., Alcoa Center, Pa.
(AD-A162555; CMU-RI-TR-85-19) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Aluminum Alloy Design Inventor (Aladin) is an expert system that aids in the design of new alloys. The system uses traditional, rule based, qualitative methods as well as quantitative calculations. Our approach is to model the design process as a collaboration among several different bodies of expertise: composition in terms of elements to be added; properties of known alloys; internal sturcture, ranging from solid phases and microstructure down to the crystal lattice structure; and thermomechanical processing of the metal. The inference mechanism is a variant of hypothesize-and-test. The present implementation combines the Carnegie Representation Language (CRL) and OPS5 along with Lisp. A database of metallurgical knowledge and data on known alloys is built in the form of CRL schemata. The execution of the system is controlled by OPS productions and most of the data produced in a specific run is represented by OPS working memory elements. This paper gives a preliminary overview of the architecture of Aladin with emphasis on the coupling of symbolic and numeric computations. We briefly describe the knowledge representation of Alloys, Phase diagrams and Microstructure information. We explain how qualitative reasoning is used to define the variables to be dealt with quantitatively and how regression among known alloys is used. We describe multidimensional constraints and how they are used to deal with interaction between variables, to implement a least commitment strategy and how they at the same time provide criteria for search termination and backtracking. GRA

N86-22177# Adaptive Sensors, Inc., Santa Monica, Calif.
AN ALGEBRAIC SYNDROME DECODING TECHNIQUE FOR CERTAIN CONVOLUTIONAL CODES Final Progress Report
I. S. Reed 25 Oct. 1985 21 p
(Contract N00014-84-C-0720)
(AD-A162636; FPR-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this final report, some of the same machinery developed in an earlier report for syndrome decoding is shown to provide a basis for what is called algebraic syndrome decoding of convolutional codes. Actually, algebraic syndrome decoders were developed quite early in a heuristic manner for certain simple convolutional codes. In particular, syndrome decoders in the form of feedback decoders were developed for the one error-correcting Wyner-Ash convolutional code. However, the generalization to algebraically constructed syndrome decoders other than feedback and majority-logic decoders seems to have been largely ignored. In order to demonstrate the general nature of algebraic syndrome decoding, some definitions and terminology are now in order. GRA

N86-22178# Boeing Aerospace Co., Kent, Wash.
SPECIFICATION TECHNOLOGY GUIDELINES Final Report, 2 Mar. 1984 - 1 Mar. 1985
David R. Addleman, Margaret J. Davis, and Edward P. Presson Aug. 1985 81 p
(Contract F30602-84-C-0073)
(AD-A162655; RADC-TR-85-128) Avail: NTIS HC A05/MF A01 CSCL 09/2

The purpose of this research was to provide the Air Force system and software development manager with an uncomplicated set of guidelines for matching existing methods and tools to the needs of specific development projects. The Specification Technology Guidelines effort was divided into five major tasks. The first task studied software requirements in six Air Force mission areas. In the performance of this task information was gathered regarding programming characteristics, software development requirements, and the support environments of typical application software. Within each mission area, differences in application and development of software most affecting methodology selection were given more attention. All Air Force software efforts were deemed to fall into 18 generic software categories. GRA

N86-22179# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
GETWRD PACKAGE UPDATE: NEW FEATURES AND MODIFICATIONS TO THE GETWRD PACKAGE Technical Communication Report
David Hally Aug. 1985 44 p
(AD-A162698; DREA-TC-85/312) Avail: NTIS HC A03/MF A01 CSCL 09/2

The GETWRD Package is a library of procedures designed to ease the implementation of command languages using FORTRAN 77. It allows the user to interpret a word of user input by matching it with one of the entries in a user-supplied dictionary. Features designed to increase the friendliness of the program/user interface include a type ahead facility, recognition of abbreviations, word completion and understandable error messages. This memorandum describes enhancements to the GETWRD Package. While most of the enhancements are of most benefit to the programmer, a major improvement to the program/user interface is the inclusion of a spelling corrector which will catch most typographical errors committed by the user. Other improvements include the ability to interpret the work of input as a simple string with no dictionary matching, a logical variable, the answer to a Yes-No question, or a number in a specified range; greater flexibility for the programmer in formatting prompt and help messages; and a sorting routine which can be used to ensure that the dictionary is in alphabetic order. All changes have been implemented to be upwardly compatible with the original version of the GETWRD Package so that no changes need be made to existing code which calls GETWRD Package procedures. GRA

N86-22180# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
BUILD: A TOOL FOR MAINTAINING CONSISTENCY IN MODULAR SYSTEMS
Richard E. Robbins Nov. 1985 60 p Revised

(Contract N00014-80-C-0505; Grant NSF MCS-81-17633)
(AD-A162744; AI-TR-874) Avail: NTIS HC A04/MF A01 CSCL 09/2

BUILD is a tool for keeping modular system in a consistent state by managing the construction tasks (e.g., compilation, linking etc.) associated with such systems. It employs a user supplied system model and a procedural description of a task to be performed in order to perform the task. This differs from existing tools which do not explicitly separate knowledge about systems from knowledge about how systems are manipulated. Build provides a static framework for modeling systems and handling construction requests that makes use of programming environment specific definitions. By altering the set of definitions, BUILD can be extended to work with new programming environments and to perform new tasks. Author (GRA)

N86-22181# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
MASTIF (MIT ANALYSIS AND SIMULATION TOOLS FOR IC FABRICATION): A WORKSTATION APPROACH TO FABRICATION PROCESS DESIGN
Duane S. Boning and Dimitri A. Antoniadis Sep. 1985 9 p
(Contract N00014-85-K-0213)
(AD-A162752) Avail: NTIS HC A02/MF A01 CSCL 13/8

The design of a fabrication process increasingly necessitates the availability and use of a variety of tools, including process and device simulation, analysis, and synthesis aids. The MASTIF workstation (MIT Analysis and Simulation Tools for IC Fabrication) is a menu and window oriented program written in C and FORTRAN which provides a methodology and uniform software structure for the connection of process and device design tools. MASTIF currently includes a facility for incremental development and version management of a process description, management mechanisms for definition of physical cross sections deriving from the overall process description, and an interactive graphics interface and data interchange for process and device simulators (SUPREM-III and MINIMOS). With MASTIF, the user can effectively develop and evaluate a fabrication process via a single integrated workstation. Author (GRA)

N86-22182# Florida State Univ., Tallahassee. Dept. of Statistics.
FAULT DIVERSITY IN SOFTWARE RELIABILITY
Philip J. Boland, Frank Proschan, and Y. L. Tong Sep. 1985 24 p Prepared in cooperation with University Coll., Dublin, Ireland and Georgia Inst. of Tech., Atlanta, Ga.
(Contract F49620-85-C-0007; Grant NSF DMS-85-02346)
(AD-A162757; FSU-STATISTICS-M714; TR-85-185; AFOSR-85-1112TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Diversity of bugs or faults in a software system is a factor contributing to software unreliability which has not yet been emphasized. This paper is written with the intention of demonstrating the impact of fault diversity on the time to detection of software bugs. A new discrete software reliability model based on the multinomial distribution is introduced. It is shown that for models of this type, the more diverse the fault probabilities are, the longer (stochastically) it takes to detect or eliminate any n faults, while the smaller (stochastically) will be the number of faults detected or eliminated during a given amount of time (or during a given number of inputs to the system). The impact of fault diversity is also demonstrated for the Jelinski-Moranda model. Author (GRA)

N86-22183# Department of the Air Force, Washington, D.C.
COMPUTER CONTROLLED LEAD FORMING Patent Application
Stephen P. Jones, inventor (to Air Force) Filed 23 Aug. 1985 19 p
(AD-D011984; US-Patent-Appl-SN-768664) Avail: NTIS HC A02/MF A01 CSCL 13/8

The present invention relates generally to the manufacturing of electrical components and specifically to an automated lead forming system for axial electrical components. The fabrication of printed circuit boards often includes the forming of wire-like leads of axial components. This forming step includes the cutting of the leads to a specific length, and the bending of the leads into a tailored configuration, using axial forming equipment. An axial lead forming machine is presented which is capable of trimming, shaping, and electrically verifying the characteristics of axial components under computer control. Two die cutting and bending assemblies are incrementally moved horizontally over the wire leads of an axial component, which is suspended between them. A set of counters, lead screws, and two electric motors initially hold the two die assemblies in a known position defined as a home location. By correlating the number of leads per inch on the lead screws and counting the number of rotations of the electric motor, the lead forming mechanism is capable of communicating to a computer the exact location of the hammer, anvil and cutting edge of the die assemblies so that a programmable setting of the trimming and shaping of the axial leads may be accomplished automatically under computer direction. GRA

N86-22184# Lawrence Livermore National Lab., Calif.
FINITE ELEMENT ANALYSIS OF THE ROQUEFORT DIAGNOSTIC CANISTER
S. M. Pratuch Aug. 1985 39 p
(Contract W-7405-eng-48)
(DE86-000837; UCID-20503) Avail: NTIS HC A03/MF A01

This document reports on the development of a simple finite element model of the Roquefort diagnostic canister. It describes the means in which the model was used to predict the canister deflection when simply supported as well as the corresponding forces, moments, and stresses in the cable trays and lifting fixtures. Also included in the report are the results of the line of sight (LOS) hardware modeling which was used to size the LOS hardware to bulkhead connections. Three canister load configurations - bare frame, bare frame plus lead shielding, and bare frame, lead, plus LOS hardware - were studied during the analysis and are presented in this report. In addition, the results of a fourth canister configuration (using the same loads as that of the third load case), initiated because of the presence of near-yield stresses in the third load configuration and the subsequent addition of cable tray stiffeners, are also included. Throughout the analysis, three computer codes were used: SLIC, to generate the canister mesh, GEMINI, to conduct the finite element data, and TAURUS, to create the finite element data. DOE

N86-22185# Geological Survey, Menlo Park, Calif.
POLYGON: AN INTERACTIVE PROGRAM FOR CONSTRUCTING AND EDITING THE GEOMETRIES OF POLYGONS USING A COLOR GRAPHICS TERMINAL
B. A. Chuchel 1985 130 p
(Contract DE-AI08-78ET-44802)
(DE86-001419; USGS-OFR-85-233) Avail: NTIS HC A07/MF A01

This report is a user manual for the FORTRAN program POLYGON. POLYGON is designed to facilitate the construction and editing of the geometries of polygonal shapes using an Envision color-graphics terminal. The Open-File Report number 85-233-B [Chuchel, 1985] contains a listing of the FORTRAN source code for the POLYGON program. POLYGON features color-graphics, an interactive user dialogue, brief help messages, and zooming to selected portions of the terminal screen in order to edit and manipulate polygons using a graphics cursor or the Envision mouse. A quadruply linked tree is used within POLYGON to represent and store the information about the geometries of the polygons. These polygonal shapes may subsequently be used by independent modeling programs to represent three-dimensional shapes of gravitational or magnetic sources; for example, output from POLYGON is directly compatible with programs MAGPOLY or GRAVPOLY and PFGRAV3D or PFMAG3D. POLYGON is written in DEC (Digital Equipment Corporation) extended FORTRAN 77 and is presently operational on the USGS, Branch of Geophysics, VAX/VMS computer. The program is written to operate on the Envision 200 series of color graphics terminals by Envision

Technology Incorporated. Suggestions are provided on converting the program to other types of color terminals. DOE

N86-22119# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
SOFTWARE DEVELOPMENT: SCIENCE OR PATCHWORK
Robert L. Baber *In its* CWI Newsletter, No. 2, March 1984 Mar. 1984 p 18-34 refs (For primary document see N86-22117 12-59)
Avail: NTIS HC A04/MF A01

N86-22124# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
VEHICLE ROUTING AND COMPUTER GRAPHICS
M. W. P. Savelsbergh *In its* CWI Newsletter, No. 7, June 1985 Jun. 1985 p 15-24 refs (For primary document see N86-22121 12-59)
(Grant STW-CWI-22-0348)
Avail: NTIS HC A03/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N86-22186# Yale Univ., New Haven, Conn. Dept. of Computer Science.
PARALLEL IMPLEMENTATION OF PRECONDITIONED CONJUGATE GRADIENT METHODS
Youcef Saad and Martin H. Schultz Oct. 1985 22 p refs Sponsored in part by IBM/Kingston
(Contract N00014-82-K-0184)
(AD-A161988; YALEU/DCS-RR-425) Avail: NTIS HC A02/MF A01 CSCL 09/2

A few different implementations of classical iterative methods on parallel processors were considered for the purpose of studying how multiprocessor architecture affects performance. The framework is that of general nonsymmetric linear systems that arise from the discretization of partial differential equations. The solution methods based Generalized Minimal Residual Algorithm (GMRES), a conjugate gradient like method, combined with well known preconditionings were examined. The architectures considered were shared memory machines and loosely coupled linear or mesh connected arrays. Author

N86-22187# Aerodyne Research, Inc., Billerica, Mass.
BIMODAL OPTICAL COMPUTER Final Technical Report, 1 Oct. 1984 - 30 Sep. 1985
H. J. Caulfield, J. H. Gruninger, K. Steiglitz, H. Rabitz, and J. Gelfand 6 Sep. 1985 21 p
(Contract DAAG29-84-C-0026)
(AD-A161399; ARI-RR-461; ARO-22455.1-PH-S) Avail: NTIS HC A02/MF A01 CSCL 09/2

Much of the current attention being given to optical computing stems from its new found ability to perform digital operations and hence to achieve high accuracy. In optics as in electronics, digital operations are slower and clumsier than analog operations. On the other hand, digital operations are more flexible and more accurate. These considerations lead us to consider whether some sorts of hybrid optical-electronic, analog-digital systems might be useful for some tasks. In this paper, we consider two closely-related hybrids: analog optics with digital electronics and analog optics with hybrid analog-digital electronics. Both systems will use analog optics for rapid and moderately accurate solution of complex problems and use the electronics to bootstrap the accuracy. That is each new optical computation should increase the accuracy of the solution. We will call such a system a Bimodal Optical Computer. While many of these concepts appear to be new to optics, they are not new to computing in general. We will attempt to document the most useful of the prior publications, to make isomorphisms with other fields explicit, and to label those contributions which appear to be new. With all of these caveats, our primary purpose is to present a general approach for using optical computers. We will illustrate that approach with one specific problem (linear algebraic equations), but this should not obscure the generality of the concept. Author (GRA)

N86-22188# Naval Postgraduate School, Monterey, Calif.
THE QUEUEING MODEL OF A PACKET SWITCH SUBJECT TO ROUTING IN COMPUTER NETWORKS Technical Report
Jin-Fu Chang Sep. 1985 46 p
(AD-A161638; NPS62-85-027) Avail: NTIS HC A03/MF A01 CSCL 09/2

In a previous paper, the steady-state behavior of a finite queue which accepts batch poisson inputs and received service from servers operating in synchronous mode was studied. An analysis was successfully completed via the application of the Residue theorem in complex variables. The study is extended to include the effect of routing and buffer sharing. Upon the arrival of a batch each customer determines its route independently according to certain probability distribution. Buffer sharing with minimum allocation is also considered. Results obtained include state probability, blocking probability, delay, and throughput. Validity of analysis has been verified by computer simulations. The system considered is a good approximate model of a packet switch in a computer network. GRA

N86-22189# North Carolina State Univ., Raleigh. Raleigh.
STUDY ON ROUTING AND FLOW CONTROL IN COMPUTER NETWORKS Final Report, 21 Sep. 1981 - 1 Jun. 1985
Wushow Chou and Arne A. Nilsson 11 Oct. 1985 10 p
(Contract DAAG29-81-K-0176)
(AD-A161768; ARO-18160.6-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The objectives of this research were the investigation of certain issues on routing, flow control, and the relationship between the two. More specifically, the following research tasks were carried out: (1) It was shown that while deterministic routing may seem to perform better under stable traffic conditions, the adaptive strategy out-performs the deterministic one for networks spanning several time zones; (2) Approximation models were determined for determining response time on a virtual circuit under the real network condition that arriving packets encountering a full window wait in buffers instead of being discarded, as in the case of earlier models; (3) A detailed simulation model was developed to verify the approximate analytic model and to perform certain experiments; (4) A strategy for determining optimal window size was developed based on the minimum-cut of a multi-commodity problem. GRA

N86-22190# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering and Computer Science.
AN ANALYSIS AND SIMULATION OF THE CRAY X-MP MEMORY SYSTEM
D. A. Calahan 1 Sep. 1985 8 p Presented at the 1st International Conference, Supercomputing, Tampa, Fla., 16-19 Dec. 1985
(Grant AF-AFOSR-0096-84)
(AD-A162769; AFOSR-85-1117TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The CRAY X-MP 2- and 4-processor memory systems are analyzed and simulated using an instruction-level timing simulation of up to 16 processors. This study indicates a disturbing counter-intuitive trend to longer delays in vector accesses as both the number of processors and memory banks increase proportionately. This delay appears to be related to access start-up delays, which are determined for various memory organizations. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N86-22191# California Univ., Irvine. Dept. of Information and Computer Science.
METHODS OF CONCEPTUAL CLUSTERING AND THEIR RELATION TO NUMERICAL TAXONOMY

Douglas Fisher and Pat Langley [1986] 39 p refs
(Contract N00014-84-K-0345)
(AD-A160221; UCI-ICS-85-26) Avail: NTIS HC A03/MF A01 CSCL 12/1

Artificial intelligence methods for machine learning can be reviewed as forms of exploratory data analysis, even though they differ markedly from the statistical methods generally connoted by the term. The distinction between methods of machine learning and statistical data analysis is primarily due to differences in the way techniques of each type represent data and structures within data. Methods of machine learning are strongly biased toward symbolic data representations. This difference is explored within a limited context, the explication of conceptual clustering, an extension to the statistically based methods of numerical taxonomy. The form of concepts used by existing conceptual clustering systems is described. Several conceptual clustering techniques are described along with sample outputs. The use of alternative concept representations to enhance the effectiveness of future conceptual clustering systems is examined. Author

N86-22192# Integrated Systems, Inc., Palo Alto, Calif.
ROBUST ADAPTIVE CONTROL Final Report, 15 Sep. 1984 - 15 Feb. 1985
Robert L. Kosut 19 Sep. 1985 59 p
(Contract F49620-84-C-0085)
(AD-A161349; ISI-61; AFOSR-85-0968TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

This project addresses the problems involved in developing an interactive software system that integrates adaptive and nonlinear control design procedures with a real-time processor for implementation. The proposed system implements complex control laws in the laboratory for rapid testing evaluation and tuning. Recent hardware development and software methodologies form the basis of computer-aided control system design (CACSD) products. The two basic elements defined in the study are: (1) A user friendly CACSD software package for product development and validation of control laws using simulation models, (2) A real-time hardware system which can automatically implement control laws designed by the CACSD software package, without real-time programming. The products proposed under this project will significantly reduce engineering development time. Many new applications will occur as more and more improved CAE tools are available and the designed control laws can be rapidly verified in the laboratory. The hardware will be capable of implementing optimal trajectories allowing more economical operation of process plants and automated manufacturing lines. Author (GRA)

N86-22193# Illinois Univ., Urbana. Decision and Control Lab.
MULTI-INPUT/MULTI-OUTPUT SENSITIVITY POINTS TUNING M.S. Thesis
Stephen T. Hung May 1985 53 p
(Contract N00014-84-C-0149)
(AD-A161641; DC-82; UILU-ENG-85-2219; R-1044) Avail: NTIS HC A04/MF A01 CSCL 12/1

Periodic tuning is a virtually essential aspect in the maintenance of almost any physical plant. One method of such tuning is that known as sensitivity points turning method. The theory of this method and application to single-input/single-output (SISO) systems has been fairly well developed. The application of sensitivity points turning concepts to the tuning of multi-input/multi-output (MIMO) systems is investigated. The concept of sensitivities in feedback systems was originally introduced in the 1940's. Methodologies for using sensitivity information for optimal tuning of system parameters date back to the late 1950's and early 1960's. These works all involve the use of system sensitivities in order to provide a searchless means of computing the gradient of a given cost function which possesses some extremal value that is related in some way to some desired characteristic performance of the system under tuning. Included in this class of optimization techniques are the iterative parameter optimization techniques.
GRA

N86-22194# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
ON A THEORY OF CONTROL FOR LINEAR SYSTEMS OVER RINGS AND NONLINEAR/TIME-VARYING SYSTEMS Final Report, 1 Jul. 1984 - 30 Jun. 1985
Erol Emre Sep. 1985 6 p
(Grant AF-AFOSR-0282-82)
(AD-A162680; AFOSR-85-0991TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

During the grant period the principal investigator wrote 18 research papers. Titles include Regulation of Linear Systems Over Rings by Dynamic Output Feedback, Control of Linear Systems with Fixed Noncommensurate Point Delays, On regulation of Linear Systems by Dynamic Output Feedback, On Globally Stable Adaptive Control, and Continuous Stabilization of Time-Varying Systems Over Parameters Approach. Author (GRA)

N86-22195# Yale Univ., New Haven, Conn. Center for Systems Science.
ADAPTIVE CONTROL OF MULTIVARIABLE SYSTEMS Interim Report, 15 Jul. 1984 - 14 Jul. 1985
A. S. Morse 1 Oct. 1985 5 p
(Grant AF-AFOSR-0242-84)
(AD-A162795; AFOSR-85-1113TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

During this period the Principal Investigator wrote six technical papers. Titles are: New directions in parameter adaptive control, Adaptive stabilization of linear systems with unknown high frequency, A smooth algorithm for adaptive stabilization of a discrete linear system with an unknown high frequency gain, A $4(n+1)$-dimensional model reference adaptive control for the stabilization of any strictly proper minimum phase linear system with relative degree not exceeding tow an dimension not exceeding phase linear system with relative degree not exceeding two and dimension not exceeding n, Adaptive stabilization of a discrete linear system with an unknown high frequency gain, and A three dimensional universal controller for the adaptive stabilization of any strictly proper minimum-phase system with relative degree not exceeding two. Author (GRA)

N86-22196# Oxford Univ. (England). Dept. of Engineering Science.
TUTORIALS ON SELF-TUNING CONTROL. VOLUME 1: INTRODUCTION TO SELF-TUNING AND ADAPTIVE CONTROL
D. W. Clarke 1985 20 p refs 2 Vol.
(OUEL-1592/85-Vol-1) Avail: NTIS HC A02/MF A01

The background to self-tuning control systems design is introduced. Reasons why self-tuning should be used are given. An elementary self-tuner for tuning a PI regulator based on an estimated model is presented. Adaptive control is introduced for the case of a plant with an unknown gain where the control objective is to regulate the output to a given set-point despite load disturbances. Author (ESA)

N86-22197# Oxford Univ. (England). Dept. of Engineering Science.
TUTORIALS ON SELF-TUNING CONTROL. VOLUME 2: AUTOMATIC TUNING OF PID REGULATORS
D. W. Clarke 1985 22 p refs 2 Vol.
(OUEL-1593/85-Vol-2) Avail: NTIS HC A02/MF A01

Pattern recognition and model based approaches to tuning of PID parameters are reviewed. It is seen that both approaches can lead to satisfactory tuning of PID parameters but they have respective strengths and weaknesses. The pattern recognition approach is quite slow and can be seriously affected by disturbances of unassumed structure. However, it appears not to depend on a model of the plant, though it has an implicit assumption that the plant response is smooth and monotonic. The model-based designs are fast to adapt but depend crucially on the assumption of model structure. In particular if the plant dead-time is different from that assumed, the closed-loop might become unstable. To avoid this problem it is important that the model parameter set be extended to encompass all possible variations; this might involve

quite a large parameter vector and a consequential computational load. Author (ESA)

N86-22198# Oxford Univ. (England). Dept. of Engineering Science.
PRINCIPAL DIRECTION ALIGNMENT, A GEOMETRIC FRAMEWORK FOR THE COMPUTER SOLUTION TO THE mu-PROBLEM
R. Daniel, B. Kouvaritakis, and H. Latchman 1985 57 p refs
(OUEL-1595/85) Avail: NTIS HC A04/MF A01

Nonsimilarity scaling results for element by element bounded perturbations, particularly the Major Principal Direction Alignment (MPDA) property, are reviewed. The block diagonal bounded perturbation problem formulation of Doyle (1982) for the case of 1x1 blocks is summarized. It is proved that a computable solution for mu is always guaranteed under MPDA, for this class of perturbation. A simple extension which allows the treatment of 1x1 blocks with different upper bounds is presented. General block structured perturbations are examined, and using the MPDA principle, a solution to the mu problem is presented. The case of repeated singular values is considered. The generality of the principal direction alignment property is established. Author (ESA)

N86-22199# Oxford Univ. (England). Dept. of Engineering Science.
NECESSARY AND SUFFICIENT STABILITY CONDITIONS FOR THE CASE OF DEPENDENT ADDITIVE PERTURBATIONS
B. Kouvaritakis and H. Latchman 1985 40 p refs
(OUEL-1596/85) Avail: NTIS HC A03/MF A01

It is shown that nondiagonal transformations afford the extra degrees of freedom required for the attainment of Principal Direction Alignment (PDA). The associated results give a necessary and sufficient stability condition, for the case of dependent perturbations. Nonsimilarity operations where the stability results have a direct geometric interpretation in terms of the plant and perturbations matrices are considered. Necessary and sufficient stability conditions for the general case in the context of similarity operations are derived. The optimal choice of these similarity transformations requires the solution of a minimization problem, which by major PDA arguments, is shown to be convex. Thus any standard optimization technique produces reliable results. Author (ESA)

N86-22200# Oxford Univ. (England). Dept. of Engineering Science.
PREDICTION OF STOCHASTIC PROCESSES USING SELF-TUNING PRINCIPLES
P. P. Kanjilal 1985 37 p refs
(OUEL-1597/85) Avail: NTIS HC A03/MF A01

Constrained minimum variance prediction using self-tuning ideas is presented. Generalized cost-functions which penalize the prediction error, and several choices of increments of prediction are considered. It is claimed that constraining the prediction increments leads to more realistic prediction strategies. An adaptive predictor based on pole-placement principles is presented. The proposed formulations are developed on an ARIMAX process model, as it is believed that such a representation is more appropriate in practice. Features are incorporated into the prediction algorithms which make them particularly suitable for real-time applications. Author (ESA)

N86-22201# Oxford Univ. (England). Dept. of Engineering Science.
ROBUSTNESS OF MULTIVARIABLE FEEDBACK SYSTEMS: ANALYSIS AND OPTIMAL DESIGN Ph.D. Thesis
Y. K. Foo 1985 295 p refs Sponsored by UK Overseas Research Student Award and Institution of Electrical Engineers
(OUEL-1601/85) Avail: NTIS HC A13/MF A01

The robustness of the stability property of multivariable feedback control systems with respect to model uncertainty is studied. By introducing a topological notion of arcwise connectivity, robust stability tests are unified. The switching-type robust stability test is easy to apply, and does not require the nominal and perturbed plants to share the same number of closed right half-plane poles, or zeros, or both. It is shown that at frequencies where there is a possibility of an uncertain pole crossing the jw-axis, robust stability is maximized by minimizing the maximum singular value of the sensitivity matrix. At frequencies where there is a likelihood of uncertain zeros crossing the imaginary axis, it is desirable to minimize the maximum singular value of the complementary sensitivity matrix. A robustness optimization problem is posed as a non-square H sup inf optimization problem. All solutions to the optimization problem are derived, and parameterized by the solutions to an equivalent two-parameter interpolation problem. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-22202 Columbia Univ., New York.
FINITE ELEMENT METHOD ANALYSIS OF NONLINEAR CONTINUA USING STOCHASTIC EQUIVALENT LINEARIZATION TECHNIQUE Ph.D. Thesis
Ion Simulescu 1985 102 p
Avail: Univ. Microfilms Order No. DA8523240

A finite element formulation for a class of nonlinear viscoelastic continua subjected to stochastic excitation has been developed by means of a stochastic equivalent linearization technique. The nonlinear viscoelastic properties of the continua are modeled in terms of the constitutive equation which linearly involves the hysteretic tensor and of the auxiliary equation which describes a nonlinear relationship among the strain and hysteretic tensors and their time derivatives. This auxiliary equation is linearized with the aid of a stochastic linearization technique which minimizes the expected value of the square of the difference between the nonlinear and linearized auxiliary equations. The linearized boundary value problem then involves a set of two linearization coefficients which are functions of space and time. With the aid of the weighted residuals method, the boundary value problem developed for the continuum is transformed into that in the finite element formulation. Dissert. Abstr.

N86-22203 Northwestern Univ., Evanston, Ill.
MULTIPLE TIME STEP PARTITIONED INTEGRATORS FOR FINITE ELEMENT EQUATIONS Ph.D. Thesis
Patrick John Smolinski 1985 109 p
Avail: Univ Microfilms Order No. DA8523595

Time integration procedures which allow different time steps within different parts of the mesh are presented for the first order semidiscretized diffusion equation and the second order semidiscretized equations of motion. Different integrators (explicit and implicit) and mesh partitions (element and node) are investigated for the first order equations. The stability of these procedures is examined numerically and analytically for the case of the element partition. Also stability guidelines for the explicit nodal partition are presented. An explicit subcycling method is analyzed for second order equations, however, the exact stability criterion has yet to be determined. Numerical examples are presented. Dissert. Abstr.

N86-22204*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ON THE BOUNDARY TREATMENT IN SPECTRAL METHODS FOR HYPERBOLIC SYSTEMS
Claudio Canuto (Inst. di Analisi Numerica del C. N. R., Pavia, Italy) and Alfio Quarteroni (Inst. di Analisi Numerica del C. N. R., Pavia, Italy) Jan. 1986 20 p refs
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178055; ICASE-86-1; NAS 1.26:178055) Avail: NTIS HC A02/MF A01 CSCL 12A

Spectral methods were successfully applied to the simulation of slow transients in gas transportation networks. Implicit time advancing techniques are naturally suggested by the nature of

the problem. The correct treatment of the boundary conditions are clarified in order to avoid any stability restriction originated by the boundaries. The Beam and Warming and the Lerat schemes are unconditionally linearly stable when used with a Chebyshev pseudospectral method. Engineering accuracy for a gas transportation problem is achieved at Courant numbers up to 100. Author

N86-22205# Wisconsin Univ., Madison. Mathematics Research Center.
IMPLICIT B-DIFFERENTIABILITY IN GENERALIZED EQUATIONS Technical Summary Report
Stephen M. Robinson Aug. 1985 13 p
(Contract DAAG29-80-C-0041; Grant NSF DCR-85-02202)
(AD-A160980; MRC-TSR-2854) Avail: NTIS HC A02/MF A01 CSCL 12/1

Generalized equations are mathematical models for nonlinear equilibrium problems in areas such as economics, transportation, etc. In such models, it is desirable to know how the solution of the model will change when the problem data change. When such a change is too hard to compute, a convenient approximation method may yield and answer that is good enough, particularly for small changes. This paper develops such an approximation. The author has previously proved an implicit-function theorem for regular solutions of generalized equations. Here he shows that when the underlying set for the generalized equation is polyhedral, as it is in many applications, then the implicit function has a Bouligand derivative defined by a formula generalizing that of the usual implicit-function theorem. This extends recent results on directional differentiability obtained by Kyparisis and others. GRA

N86-22206# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON THE DISTANCE BETWEEN MIXED POISSON AND POISSON DISTRIBUTIONS Technical Report, Sep. 1985 - Aug. 1986
Dietmar Pfeifer Sep. 1985 20 p
(Contracts F49620-82-C-0009; F49620-85-C-0144)
(AD-A161337; TR-115; AFOSR-85-0956TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Estimations and asymptotic expansions for several distances between mixed Poisson and Poisson distributions are given, such as the total variation distance, the Kolmogorov distance and a specific Wasserstein distance (Fortet-Mourier distance). As an example, the author generalizes and improves results of Vervaat (1969) on the total variation distance between negative binomial and Poisson distributions. The main tool is an appropriate application of operator semigroups and their probabilistic representation theory. Author (GRA)

N86-22207# Duke Univ., Durham, N. C. Dept. of Computer Science.
FINDING CRITICAL SETS
Donald W. Loveland 13 Sep. 1985 16 p Revised
(Grants AF-AFOSR-0205-83; AF-AFOSR-0221-81)
(AD-A161368; CS-1985-22; AFOSR-85-0951TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several algorithms are given for finding a critical subset S determined by a binary monotonic set function over a given set U. A set S is critical if f(T) = 1 for all T such that S is a subset of T and f (R) = O for all R such that R is a perfect subset of S. Upper bounds on the worst case times for the algorithms, determined by the number of calls to the binary set function, vary downwards from 2r(log(base 2) n) function calls. Here n is the size of U and r is the size of the critical set found. We find that the conceptually easiest algorithm is not the easiest to program and also that the algorithms with better upper bounds fare more poorly in practice, based on a small sample of random trails. Although finding one critical set is easy we also show that it can quickly get very difficult to find additional critical sets, simply because it can be hard to separate known critical sets from further possible critical sets. Author (GRA)

N86-22208# Harvard Univ., Cambridge, Mass. Center for Research in Computer Technology.
MOTION PLANNING IN THE PRESENCE OF MOVING OBSTACLES
John H. Reif and Micha Sharir 1985 30 p
(Contract N00014-80-C-0647)
(AD-A161374; TR-06-85) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper investigates the computational complexity of planning the motion of a body B in 2-D or 3-D space, so as to avoid collision with moving obstacles of known, easily computed, trajectories. Dynamic movement problems are of fundamental importance to robotics, but their computational complexity has not previously been investigated. We provide evidence that the 3-D dynamic movement problem is intractable even if B has only a constant number of degrees of freedom of movement. In particular, we prove the problem is PSPACE-hard if B is given a velocity modulus bound on its movements and is NP hard even if B has no velocity modulus bound, where in both cases B has 6 degrees of freedom. To prove these results we use a unique method of simulation of a Turing machine which uses time to encode configurations (whereas previous lower bound proofs in robotics used the system position to encode configurations and so required unbounded number of degrees of freedom). We also investigate a natural class of dynamic problems which we call asteroid avoidance problems: B, the object we wish to move, is a convex polyhedron which is free to move by translation with bounded velocity modulus and the polyhedral obstacles have known translational trajectories but cannot rotate. This problem has many applications to robot, automobile, and aircraft collision avoidance. GRA

N86-22209# Harvard Univ., Cambridge, Mass. Computation Lab.
COMPLEXITY OF THE GENERALIZED MOVER'S PROBLEM
John H. Reif 1985 38 p
(Contract N00014-80-C-0647)
(AD-A161378; TR-04-85) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper concerns the problem of planning a sequence of movements of linked polyhedra through 3 dimensional Euclidean space, avoiding contact with a fixed set of polyhedra obstacles. That this generalized mover's problem is polynomial space hard is proved. The proof provides strong evidence that robot movement planning is computationally intractable, i.e., any algorithm requires time growing exponentially with the number of degrees of freedom. GRA

N86-22210# North Carolina Univ., Chapel Hill. Center for Stochastic Processes
ON PREDICTION OF HARMONIZABLE STABLE PROCESSES Technical Report, Sep. 1984 - Aug. 1985
S. Cambanis and A. G. Miamee Jul. 1985 46 p
(Contract F49620-82-C-0009)
(AD-A161412; TR-110; AFOSR-85-0950TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Spectral and time domain criteria for a harmonizable stable process to be regular are given, which provide an orthogonal moving average representation. Also criteria for such processes to have linear predictor filters are obtained; these include the positivity of the distance and of the angle between past and future. In the process, the notion of angle between isotropic complex stable random variables is introduced and studied. GRA

N86-22211# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON STOCHASTICAL INTEGRATION BY SERIES OF WIENER INTEGRALS Technical Report, Sep. 1984 - Aug. 1985
Jan Rosinski Aug. 1985 33 p
(Contract F49620-82-C-0009)
(AD-A161514; TR-112; AFOSR-85-0947TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Stochastic integrals of random functions with respect to a white noise random measure are defined in terms of random series of usual Wiener integrals. Conditions for the existence of such integrals are obtained in terms of the nuclearity of certain operators

on L2-spaces. The relation with the Fisk-Stratonovich symmetric integral is also discussed. Author (GRA)

N86-22212# Harvard Univ., Cambridge, Mass. Computation Lab.
SHORTEST PATHS IN EUCLIDEAN SPACE WITH POLYHEDRAL OBSTACLES
John H. Reif and James A. Storer Apr. 1985 57 p
(Contract N00014-80-C-0647)
(AD-A161599; TR-05-85) Avail: NTIS HC A04/MF A01 CSCL 12/1

The problem of finding a minimum length path between two points in Euclidean space which avoids a set (not necessarily convex) of polyhedral obstacles; we let n denote the number of the obstacle edges and k denote the number of islands in the obstacle space. For two dimensions, an island is defined to be a maximal convex obstacle surface such that for any two points contained in the interior of the island, a minimal length path between these two points is strictly contained in the interior of the island; for example, a set of i disconnected convex polyhedra forms a set of i islands, however, a single non-convex polyhedron will constitute more than one island. GRA

N86-22213# Florida State Univ., Tallahassee.
ON THE LIMIT BEHAVIOR OF A MULTI-COMPARTMENT STORAGE MODEL WITH AN UNDERLYING MARKOV CHAIN. PART II: WITH NORMALIZATION
Eric S. Tollar Feb. 1985 27 p
(Contract DAAG29-82-K-0168)
(AD-A161661; FSU-STATISTICS-M694; TR-D-77-ARO; ARO-19367.31-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

A multi-compartment storage model with one way flow is considered. The inputs and outputs for each compartment are controlled by a denumerable state Markov chain. Assuming finite first and second moment conditions, the limit behavior of the compartments is examined. It is shown that the diverging compartments under suitable normalization converge to functionals of multivariate Brownian motion, independent of those compartments which converge without normalization. Author (GRA)

N86-22214# Mississippi State Univ., Mississippi State. Dept. of Mathematics.
A STUDY OF SINGULARITIES IN BOUNDARY-FITTED COORDINATE SYSTEMS Final Report, 16 Aug. 1983 - 15 Aug. 1985
Helen V. McConnaughey 9 Oct. 1985 45 p
(Contract DAAG29-83-K-0101)
(AD-A161756; ARO-19979.3-EG) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many problems in science and engineering require the solution of a system of partial differential equations on a complex two- or three-dimensional domain. In order to solve such a problem numerically, a boundary-fitted coordinate system is usually constructed. For geometries of practical importance, it is often necessary to partition the domain and to fit a separate coordinate system to each subregion. Patching these subsystems together to form a composite system can produce irregular grid structures where the numerical scheme of solution must be modified. Methods for treating nonstandard (special) grid points in two-dimensional configurations were developed and reported earlier in the course of this project. Verification of these methods through computer experimentation and extension of the methods to special points in three-dimensional grids were the primary objectives of the project reported here. GRA

N86-22215# Army Military Personnel Center, Alexandria, Va.
AN ADAPTIVE MESH ALGORITHM FOR SOLVING SYSTEMS OF TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
David C. Arney Aug. 1985 263 p
(AD-A161822; AD-E900526) Avail: NTIS HC A12/MF A01 CSCL 12/1

This thesis discusses and adaptive mesh algorithm that can be used with a finite difference or finite element scheme to solve initial-boundary value problems for vector systems of time dependent partial differential equations in two space dimensions. This algorithm combines the adaptive technique of mesh moving, static rezoning, and local mesh refinement. The nodes of a coarse mesh of quadrilateral cells are moved by a simple algebraic node movement function. The local mesh refinement method recursively divides cells of the moving coarse mesh within clustered regions that contain nodes with large error until a user prescribed error tolerance is satisfied. GRA

N86-22216# Georgia Univ., Athens. Dept. of Chemistry.
SYSTEMATICS OF STRONGLY SELF-DOMINANT HIGHER ORDER DIFFERENTIAL EQUATIONS BASED ON THE PAINLEVE ANALYSIS OF THEIR SINGULARITIES
R. B. King 16 Dec. 1985 20 p
(Contract N00014-84-K-0365)
(AD-A162545; TR-14) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a simple way of classifying higher order differential equations based on the requirements of the Painleve' property, i.e., the presence of no movable critical points. The fundamental building blocks for such equations may be generated by strongly self-dominant differential equations. Such differential equations having both a constant degree d and a constant value of the difference n-m form a Painleve' chain; however, only three of the many possible Painleve' chains can have the Painleve' property. Among the three Painleve' chains which can have the Painleve' property, one contains the Burgers' equation; another contains the dominant terms of the first Painleve' transcendent, the isospectral Korteweg-de Vries equation, and the isospectral Boussinesq equation; and the third contains the dominant terms of the second Painleve' transecendent and the isospectral modified (cubic) Korteweg-de Vries equation. Differential equations of the same order and having the same value of the quotient (n-m)/(d-1) can be mixed to generate a new hybrid differential equation. In such cases a hybrid can have the Painleve' property even if only one of its components has the Painleve' property. Such hybridization processes can be used to generate the various fifth-order evolution equations of interest, namely the Caudrey-Dodd-Gibbon, Kuperschmidt, and Morris equations. GRA

N86-22217# Georgia Univ., Athens. Dept. of Physics and Astronomy.
EXACT DYNAMICALLY CONVERGENT CALCULATIONS OF THE FREQUENCY-DEPENDENT DENSITY RESPONSE FUNCTION
J. Hong and M. H. Lee 5 Nov. 1985 14 p
(Contract N00014-85-K-0365)
(AD-A162570; AD-E900528; TR-9) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general expression for the response function is derived by the method of recurrence relations. Memory effects appear as corrections to the dynamic RPA form. The dynamic structure for the 3d electron gas is calculated to third order and compared with Al data as a large wave vector. Also shown is the dynamic local-field term. Author (GRA)

N86-22218# State Univ. of New York, Stony Brook. Dept. of Applied Mathematics and Statistics.
NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS Annual Report, 30 Sep. 1984 - 29 Sep. 1985
Reginald P. Tewarson Sep. 1985 10 p
(Grant AF-AFOSR-0383-84)
(AD-A162722; AFOSR-85-1120TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Investigators have been able to develop a computer code which has turned out to be quite competitive with a well established code. The new approach implements a variable order finite difference scheme which does not require derivatives of the given function and which uses no information outside a subinterval to approximate the given system in that subinterval. Three papers have been published as a result of this effort, with the following titles: (1) An adaptive boundary value Runge-Kutta solver for first

order boundary value problems, on the solution of sparse nonlinear evaluations and some applicattions; and (2) A quasi-Newton method with sparse triple factorization. GRA

N86-22219# Massachusetts Inst. of Tech., Cambridge. lab. for Information and Decision Systems.
THE REDUCTION OF PERTURBED MARKOV GENERATORS: AN ALGORITHM EXPOSING THE ROLE OF TRANSIENT STATES
Jan R. Rohlicek and Alan S. Willsky Sep. 1985 54 p
(Grant AF-AFOSR-0258-82)
(AD-A162773; LIDS-P-1493; AFOSR-85-1119TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

A new algorithm for the hierarchical aggregation of singularly perturbed finite-state Markov processes is derived. The approach taken bridges the gap between conceptually simple results for a relatively restricted class of processes and the significantly more complex results for the general case. The critical role played by (almost) transient states is exposed resulting in a straightforward algorithm for the construction of a sequence of aggregate generators associated with various time scales. These generators together provide a uniform asymptotic approximation of the original probability transition function. Author (GRA)

N86-22220# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
A MARKOV CHAIN APPROACH TO ELECTROCARDIOGRAM MODELING AND ANALYSIS
Peter C. Doerschuk Apr. 1985 404 p
(Grant AF-AFOSR-0258-82)
(AD-A162776; LIDS-TH-1452; AFOSR-85-1127TR) Avail: NTIS HC A18/MF A01 CSCL 12/1

A novel class of models of the electrocardiogram using interacting Markov chains is developed and used as a basis for signal processing. The modeling methodology emphasizes a balance between the inclusion of physiological detail and practicality for signal processing. In order for signal processing algorithms based on the model to achieve accurate, detailed classification of the electrocardiogram, it is necessary to include physiological detail in the model. On the other hand, in order to make the signal processing practical, the models are restricted by imposing spatial, temporal, and hierarchical decompositions. A signal processing algorithm for a wave tracking problem relevant to rhythm classification is proposed. The algorithm is decomposed to mirror the spatial decomposition of the model. On the other hand, in order to make the signal processing practical, the models are restricted by imposing spatial, temporal, and hierarchical decompositions. A signal processing algorithm for a wave tracking problem relevant to rhythm classification is proposed. The algorithm is decomposed to mirror the spatial decomposition of the model. Limited simulations indicate that reasonable performance may be attainable. GRA

N86-22221# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON CONSERVATIVE DIFFERENCE SCHEMAS
A. A. Samarskiy 5 Dec. 1985 21 p Transl. into ENGLISH from the booko. "Problemy Prikladnoy Matematiki i Mekhaniki Sbornik Statey" Moscow, 1971 p 129-136
(AD-A162798; FTD-ID(RS)T-0889-85) Avail: NTIS HC A02/MF A01 CSCL 12/1

The broadening of the scope of difference methods and the associated increase of demands on them stimulate interest in formulating general principles of obtaining difference schemas of a definite quality for problems of mathematical physics. The possibility of assigning to the same differential equation an infinite set of difference schemas defined on the same template and having the same order of approximation makes the problem of choosing the desired schema a very complex one. It is required of any numerical method that it supply and approximate solution of the problem with preset accuracy epsilon > 0 in a finite number of operations. Moreover, it is required that the schema be universal (suitable for a rather broad class of problems), homogeneous, stable, and economical (more precisely, that the numerical algorithm used to solve the difference equations be economical). GRA

N86-22222# Aerospace Corp., El Segundo, Calif.
ANALYSIS OF A LINEAR ANTENNA TWO WAVELENGTHS LONG: CONSIDERATION OF OPTIONS
Gwendolyn M. Shaw and Randolph H. Ott 1 Nov. 1985 45 p
(AD-A162799; TR-0086(6925-05)-2; SD-TR-85-87) Avail: NTIS HC A03/MF A01 CSCL 09/5

The far-zone electric field of a wire dipole antenna is numerically determined by the method of moments. Additional numerical methods that are used and compared are finite differences for computing a first derivative and L-V decomposition and the conjugate gradient method for solving linear equations. These additional methods are compared in terms of their agreement with previously accepted results and their computer execution time and memory requirements. GRA

N86-22223# North Carolina Univ., Chapel Hill. Chapel Hill Center for Stochastic Processes.
INVARIANCE PRINCIPLES UNDER A TWO-PART MIXING ASSUMPTION
Richard C. Bradley and Magda Peligrad Oct. 1985 45 p
(Contract F49620-85-C-0144; Grants NSF DMS-84-01021; NSF DMS-85-03016)
(AD-A162800; TR-122; AFOSR-85-1106TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this document weak and strong invariance principles are established for strictly stationary sequences satisfying a mixing assumption which has two parts, one based on the strong mixing condition with a polynomial mixing rate and the other based on the o-mixing condition. Author (GRA)

N86-22224# Atlanta Univ., Ga. Dept. of Physics.
INVESTIGATION OF PERTURBATION TECHNIQUES FOR NON-LINEAR DIFFERENCE EQUATIONS AND OTHER RELATED PROBLEMS Progress Report, Jul. 1984 - Mar. 1985
R. E. Mickens Mar. 1985 7 p
(Contract DE-AS05-83ER-13123)
(DE86-001162; DOE/ER-13123/1) Avail: NTIS HC A02/MF A01

A summary of the highlights of research on perturbation techniques for nonlinear difference equations performed since August 1, 1984 is given. The Appendix cites additional items which are directly related to the research proposed in the grant: (1) conferences attended, (2) abstracts, (3) lectures presented by the Principal Investigator, (4) theses' directed, and (5) publications. DOE

N86-22225# Tilburg Univ. (Netherlands). Dept. of Economics.
COMMENT ON: IDENTIFICATION IN THE LINEAR ERRORS IN VARIABLE MODELS
Paul A. Bekker 1985 11 p refs Sponsored by Netherlands Organization for the Advancement of Pure Research
(FEW-159) Avail: NTIS HC A02/MF A01

A model for multiple regression with errors is considered. The fact that one sentence proved in Kapteyn-Wansbeek's paper Identification in the linear errors in variables model (1983) is not exact is noted. A necessary and sufficient condition for identification in the linear error for variable model of a parameter normally distributed is proved. Author (ESA)

N86-22226# Oxford Univ. (England). Dept. of Engineering Science.
RECURSIVE ESTIMATION FOR NONLINEAR WIENER SYSTEMS BY ONLINE IMPLEMENTATION OF BAYE'S RULE
O. L. R. Jacobs Aug. 1985 23 p refs
(OUEL-1471/83) Avail: NTIS HC A02/MF A01

A linearization which permits on-line estimation of multiple random variables when their weighted sum is observed through severe nonlinearity is presented. Analysis to guarantee nice properties of the procedure is not available. For modest numbers of random variables the on-line computing requirements are readily met by microcomputers. The power of the Gaussian approximation

in estimating a constant random variable is shown. The observed convergence of computed conditional distributions towards the normal shape is a surprise: it might be a manifestation of the central limit theorem. Author (ESA)

N86-22227# Oxford Univ. (England). Dept. of Engineering Science.
FINITE ELEMENT ANALYSIS OF TWO CYLINDRICAL EXPANSION PROBLEMS INVOLVING NEAR INCOMPRESSIBLE MATERIAL BEHAVIOUR
H. J. Burd and G. T. Houlsby 1985 46 p refs
(OUEL-1580/85; SM056/85) Avail: NTIS HC A03/MF A01

Numerical problems which arise in the analysis of incompressible or near-incompressible material elastoplasticity using the displacement formulation of the finite element method are discussed. These effects are caused by the additional kinematic constraints imposed on the nodal velocities by the incompressibility condition. The detrimental effect of these additional constraints depends on mesh topology and element formulation, and are investigated with reference to a small strain thick-cylinder problem, and a large strain cavity expansion problem, both of which have closed form solutions. The study confirms that as Poisson's ratio is increased from a low number towards 0.5, the accuracy of the calculated stresses deteriorates. These errors are associated mainly with the mean stress, the deviatoric terms remaining relatively unaffected. Author (ESA)

N86-22228# Oxford Univ. (England). Dept. of Engineering Science.
A LARGE STRAIN FINITE ELEMENT FORMULATION FOR ONE DIMENSIONAL MEMBRANE ELEMENTS
H. J. Burd and G. T. Houlsby 1985 22 p refs Sponsored by UK Science and Engineering Research Council
(OUEL-1603/85; SM061/85) Avail: NTIS HC A02/MF A01

A finite element formulation suitable for large strain analysis of one dimensional membranes applicable to the analysis of problems in soil mechanics involving reinforced earth is described. The finite element equations, derived for a plane strain isoparametric element of arbitrary order, are cast in the small displacement form, but with a modified material stiffness matrix. In this formulation, full account is taken of element rotations during each load step, an affect which is important when stresses cease to be insignificant when compared with the material modulus. The method is illustrated with a large displacement test problem which has a known closed form solution. The application of the formulation to the analysis of a reinforced unpaved road is demonstrated.
Author (ESA)

N86-21885# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
FRACTIONAL CALCULUS TO REPRESENT COMPLEX MODULUS
Lynn Rogers *In its* Vibration Damping 1984 Workshop Proceedings Nov. 1984 4 p refs (For primary document see N86-21883 12-39)
Avail: NTIS HC A99/MF A01 CSCL 20/11

N86-21941*# PRC Kentron, Inc., Hampton, Va.
DIGITAL FILTERING AND ACCELERATION PULSE INTERPRETATION
E. L. Pasanella *In* NASA. Langley Research Center Full-Scale Transport Controlled Impact Demonstration Jan. 1986 p 103-123 refs (For primary document see N86-21933 12-39)
Avail: NTIS HC A16/MF A01 CSCL 12A

N86-22118# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
TWO APPLICATIONS OF TOPOLOGICAL DYNAMICS IN COMBINATORIAL NUMBER THEORY
Jan deVries *In its* CWI Newsletter, No. 2, March 1984 Mar. 1984 p 2-17 refs (For primary document see N86-22117 12-59)
Avail: NTIS HC A04/MF A01

N86-22122# Limburg State Univ., Maastricht (Netherlands).
SECOND ORDER APPROXIMATIONS
Willem Albers *In* CWI CWI Newsletter, No. 7, June 1985 Jun. 1985 p 2-7 (For primary document see N86-22121 12-59)
Avail: NTIS HC A03/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-22229 Houston Univ., Tex.
POWERS OF TESTS FOR CONSTANT REGRESSION COEFFICIENTS UNDER SEVERAL ALTERNATIVE MODELS Ph.D. Thesis
Chi-Si Hwu 1984 104 p
Avail: Univ. Microfilms Order No. DA8523283

It is common in time series regression work, in such fields as economics and finance, that the statistical relationship under consideration may not remain constant over time, but appears to be subject to some kinds of changes. When linear regression models with random coefficients are used in applications, a question of fundamental importance is whether the regression coefficients are constant over time. If they are then ordinary least-squares techniques can be applied. If not, then more efficient procedures are available. Several tests for constancy of regression coefficients have been developed for the random walk coefficient model. However, other random models are also possible. To some extent, tests designed to detect random walk coefficients may still reject the null hypothesis of constant regression coefficients even if the coefficients actually follow some other random model. At present, not much is known about the sensitivity of these tests to alternative models. The purpose of this dissertation research is: (1) to examine powers of tests designed to detect random walk coefficients when the coefficients in fact follow other regimes, and (2) to adapt existing test procedures to alternative models and to compare powers of these new tests. Dissert. Abstr.

N86-22230# Florida State Univ., Tallahassee. Dept. of Statistics.
PIECEWISE GEOMETRIC ESTIMATION OF A SURVIVAL FUNCTION
Gillian M. Mimmack and Frank Proschan Apr. 1985 50 p
(Contract F49620-82-K-0007)
(AD-A161322; FSU-STATISTICS-M700; TR-176;
AFOSR-85-0953TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A statistical procedure that uses incomplete data to estimate failure rate and survival functions is described. Although the procedure is designed for discrete distributions, it applied in the continuous case also. The procedure is based on the assumption of a piecewise constant failure rate. The resultant survival function estimator is a piecewise geometric function, denoted the Piecewise Geometric Estimator (PEGE). The PEGE is the discrete version of the piecewise exponential estimators proposed independently by Kitchin, Langberg and Proschan (1983) and Whittemore and Keller (1983), and it is a generalization of an estimator of Umholtz (1984) who considers complete data taken from an exponential distribution. The PEGE is consistent and asymptotically normal under conditions more general than those of the model of random censorship. Although the PEGE and the widely used Kaplan-Meier estimator (KME) are asymptotically equivalent and generally interlace, the PEGE is expected to perform better than the KME in terms of small sample properties. GRA

N86-22231# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
[FUNDAMENTAL ASPECTS OF FILTERING THEORY, STATISTICAL SIGNAL PROCESSING AND STOCHASTIC VARIATIONAL PROBLEMS RELATED TO ESTIMATION OF MARKOV RANDOM FIELDS] Final Technical Report, 15 Mar. 1984 - 15 Mar. 1985
Sanjoy K. Mitter and Bernard Levy Jun. 1985 22 p

(Grant AF-AFOSR-0135-82)
(AD-A161334; AFOSR-85-0948TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The following fundamental aspects of Stochastic Systems Theory are discussed: filtering, statistical signal processing and related problems in scattering and inverse scattering theory; theory of Markov random fields and related questions in image processing and image understanding; stochastic variational calculus and stochastic adaptive control; and parallel and distributed algorithms for statistical signal processing. GRA

N86-22232# Florida State Univ., Tallahassee. Dept. of Statistics.
EFFICIENCY LOSS WITH THE KAPLAN-MEIER ESTIMATOR
Myles Hollander, Frank Proschan, and James Sconing Aug. 1985 22 p
(Contract F49620-85-C-0007; Grant AF-AFOSR-85-C-0007)
(AD-A161341; FSU-STATISTICS-M707; TR-85-181; AFOSR-85-0975TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The proportional hazards model is considered where the distribution G of the censoring random variable is related to the distribution F of the lifetime random variable via (1 G)=(1 - F) to the beta power. Nonparametric estimators of F are developed for the case where beta is unknown and the case where beta is known. Of interest in their own right, these estimators also enable us to study the robustness of the Kaplan-Meier estimator (KME) in a nonparametric model for which it is not the preferred estimator. Comparisons are based on asymptotic efficiencies and exact mean square errors. We also compare the KME to the empirical survival function, thereby providing, in a nonparametric setting, a measure of the loss in efficiency due to the presence of censoring. GRA

N86-22233# North Carolina Univ., Chapel Hill. Dept. of Statistics.
EXISTENCE OF RANDOM VARIABLES WITH VALUES IN THE DUAL OF A NUCLEAR SPACE Technical Report, Sep. 1985 - Aug. 1986
S. Ramaswamy Sep. 1985 10 p
(Contract F49620-82-C-0009)
(AD-A161343; TR-116; AFOSR-85-0957TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Some results of L. Schwartz's theory of randomifying maps to prove existence theorems for infinite dimensional valued random variables are discussed. As a consequence, we deduce some known results in this direction due to K. Ito, M. Perez-Abreu C., and T. Bojdecki and L.G. Gorostiza are deduced. GRA

N86-22234# Stanford Univ., Calif. Dept. of Statistics.
TIME SERIES ANALYSIS AND MULTIVARIATE STATISTICAL ANALYSIS Final Report, 1 Jul. 1982 - 31 Jul. 1985
Theodore W. Anderson Sep. 1985 7 p
(Contract DAAG29-82-K-0156)
(AD-A161375; ARO-19065.15-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

The probability of an estimated moving average model being noninvertible was characterized. Generalizations of autocorrelation and partial autocorrelation coefficients are suggested for determining the orders of autoregressive moving average processes. Maximum likelihood estimators and likelihood ratio criteria were derived for a class of elliptically contoured distributions. Zonal polynomials were developed as characteristic vectors of a matrix of polynomials. Author (GRA)

N86-22235# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
RANDOM INTEGRAL REPRESENTATIONS FOR CLASSES OF LIMIT DISTRIBUTIONS SIMILAR TO LEVY CLASS L(O)
Zbigniew J. Jurek Sep. 1985 32 p Prepared in cooperation with Auburn Univ., Ala.
(Contract F49620-82-C-0009)
(AD-A161413; TR-117; AFOSR-85-0958TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

For a linear operator Q, on a Banach space E, and a real number beta, there are introduced classes, mu sub beta (O), of some limit distributions such that mu sub O(I) coincides with the Levy class LO. Elements from mu sub beta (Q) are characterized in terms of convolution equations and as probability distributions of some random integral functionals. The continuity and fix points of this random mapping is studied. It is shown that fix points coincide with the class of Q-stable measures. GRA

N86-22236# Illinois Univ., Urbana. Coordinated Science Lab.
CORRELATION IN COUPLED QUEUES AND SIMULATION OF A STOCHASTIC APPROXIMATION PROCEDURE FOR MULTIACCESS COMMUNICATIONS
Walter E. Brady Mar. 1985 64 p
(Contract N00014-84-C-0149)
(AD-A161515; R-1030; UILU-ENG-85-2205) Avail: NTIS HC A04/MF A01 CSCL 17/2

In this report, two separate topics in queing theory are discussed. In the first half of the thesis, methods are presented that are used to show that quantitative evidence of correlation exists in intuitively correlated coupled systems. The second half of this thesis concerns the use of simulations to verify that predictions are valid for specific random access control strategies. These control strategies include cases where the number of stations is allowed to slowly vary. Author (GRA)

N86-22237# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision.
MARKOV CHAINS WITH RARE TRANSITIONS AND SIMULATED ANNEALING
John N. Tsitsiklis Sep. 1985 26 p
(Contract DAAG29-84-K-0005)
(AD-A161598; LIDS-P-1497; ARO-20980.32-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

Markov chains in which the entries of the one-step transition probability matrix are known to be of different orders of magnitude and whose structure (that is, the orders of magnitude of the transition probabilities) does not change with time are considered. For such Markov chains a method is presented for generating order of magnitude estimates for the t-step transition probabilities, for any t. The algorithms of the simulated annealing type may be represented by a Markov chain which is approximately stationary over fairly long time intervals. Using the results a characterization of the convergent cooling schedules for the general class of algorithms of the simulated annealing type is obtained. GRA

N86-22238# Texas A&M Univ., College Station. Dept. of Statistics.
STATIONARY TIME SERIES, QUANTILE FUNCTIONS, NONPARAMETRIC INFERENCE AND RANK TRANSFORM SPECTRUM M.S. Thesis
Avrahan Harpaz Sep. 1985 74 p
(Contracts N00014-84-K-0350; DAAG29-83-K-0051)
(AD-A161749; TR-A-31; ARO-20140.7-MA) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this dissertation, weak convergence results for dependent sequences are used to derive the asymptotic distribution of linear rank statistics for the two sample problem. It is shown that the asymptotic variance of linear rank statistics when computed from two independent time series depends on the spectrum of the rank transform time series. The behavior of the rank transform spectrum in terms of its relations to the original spectrum is also empirically examined. Author (GRA)

N86-22239# Stanford Univ., Calif. Dept. of Operations Research.
LARGE-SAMPLE THEORY FOR STANDARDIZED TIME SERIES: AN OVERVIEW
Peter W. Glynn and Donald L. Iglehart Aug. 1985 22 p
(Contract DAAG29-84-K-0030; Grant NSF MCS-82-3438)
(AD-A161767; TR-10; ARO-20927.10-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

There are two basic approaches to constructing confidence intervals for steady-state parameters from a single simulation run.

The first is to consistently estimate the variance constant in the relevant central limit theorem. This is the approach used in the regenerative, spectral, and autoregressive methods. The second approach (standardized time series, STS) due to SCHRUBEN is to cancel-out the variance constant. This second approach contains the batch means method as a special case. The large-sample properties of the confidence intervals generated by the STS method are discussed. In particular, the asymptotic (as run size becomes large) expected value and variance of the length of these confidence intervals is studied and shown to be inferior to the behavior manifested by intervals constructed using the first approach. Author (GRA)

N86-22240# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
EXTREMA AND LEVEL CROSSINGS OF x(2) PROCESSES Technical Report, Sep. 1984 - Aug. 1985
Michael Aronowich and Robert J. Adler Aug. 1985 35 p
(Contract F49620-82-C-0009)
(AD-A162398; TR-113; AFOSR-85-0982TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The sample path behavior of sq X processes in the neighborhood of their level crossings and extreme is studied via the development of Slepian model processes. The results, aside from being of particular interest in the study of sq X processes, have a general interest insofar as they indicate which properties of Gaussian processes (which has been heavily researched in this regard) are mirrored or lost when the assumption of normality is not made. Particular emphasis is placed on the behavior of sq X processes at both high and low levels, these being of considerable practical importance. Also extended are previous results on the asymptotic Poisson form of the point process of high maxima to include also low minima (which are in a different domain of attraction) thus closing a gap in the theory of 59 sq X processes. GRA

N86-22241# Stanford Univ., Calif. Lab. for Computational Statistics.
BOOTSTRAPPING COX'S REGRESSION MODEL Technical Report
Nils L. Hjort Nov. 1985 61 p
(Contract N00014-83-K-0472; Grant NSF MCS-80-24649)
(AD-A162443; LCS-TR-21) Avail: NTIS HC A04/MF A01 CSCL 12/1

Statistical inference in Cox's regression model is usually carried out using traditional (first order) large sample theory. In the spirit of earlier success stories one might try to bootstrap data in order to better assess the sampling variability of the Cox estimator. Such a bootstrap scheme is proposed in this paper. An asymptotic justification is given, showing that inference based on the bootstrap procedure is first order equivalent to the standard one. The problem of constructing more accurate moderate-sample confidence intervals is also addressed, employing second order fine-tuning of the bootstrap. Author (GRA)

N86-22242# Iowa Univ., Iowa City.
ON MINI CONFERENCE ON ORDER RESTRICTED INFERENCE HELD AT IOWA UNIVERSITY CAMPUS ON 11-13 SEPTEMBER 1985 Final Report
Richard Dykstra and Tim Robertson Nov. 1985 26 p Conference held in Iowa City, Iowa, 11-13 Sep. 1985
(Contract N00014-85-G-0161)
(AD-A162478) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report contains a list of participants and abstracts of some of the 20 papers which were presented. The majority of papers presented at the conference are currently being organized to appear in a Conference Proceedings Volume to be published by Springer-Verlag during the summer of 1986. GRA

N86-22243# Northeastern Univ., Boston, Mass.
INVESTIGATIONS ON STATISTICS OF TERRAIN HEIGHT Final Report, Jan. - Oct. 1984
H. R. Raemer and C. K. Chow Sep. 1985 317 p
(Contract F19628-84-K-0007)
(AD-A162517; RADC-TR-85-178) Avail: NTIS HC A14/MF A01 CSCL 12/1

Three related but independent analytical investigations are reported in this document. The first is investigation of a binary hypothesis test to determine whether a given population of terrain height samples is more likely to have originated from a Gaussian or an expotential probability distribution. The input data for the test are assumed to be finitely sampled and quantized. Two tests are considered, one based on the assumption of continuously varying input data and the other based on finitely sampled and quantized data. Bivariate distributions with multiple observations are assumed. The second investigation concerns two classes of interpolation problems. The first is the inference of terrain height values at points for which no direct measurements are available using measured height values at other points, and using maximum likelihood estimator theory as a basis for the interpolation. The second is that of inferring the joint PDF of terrain height values of points at which height measurements have not been made. In both of these investigations, the effect of external constraints on heights and height differences are also considered. The third investigation concerns a continuation of a study initiated on a previous contract, sampling, and quantization errors in estimator of mean, variance and covariance of terrain heights. Author (GRA)

N86-22244# Wisconsin Univ., Madison. Dept. of Statistics.
THE 25TH CONFERENCE ON STATISTICAL THEORY AND PRACTICE HELD AT THE UNIVERSITY OF WISCONSIN, MADISON ON 29-31 MAY 1985 Final Report
George E. P. Box and Richard A. Johnson 1985 23 p Conference held at Madison, Wis., 29-31 May 1985
(Contract N00014-85-G-0073)
(AD-A162645) Avail: NTIS HC A02/MF A01 CSCL 12/1

The formal program consisted of seven invited paper sessions: Bayesian inference, inference, biostatistics, time series, quality and reliability, experimental design, and modelling and data analysis. There were three contributed paper sessions, a panel discussion on the future of statistics in industry and government and a banquet speech. The 23 distinguished speakers at the invited paper sessions all gave first rate presentations incorporating their latest findings within the framework of recent major advances in the area. Author (GRA)

N86-22245# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
[STATISTICAL METHODOLOGIES APPROPRIATE IN CENSORED SURVIVAL ANALYSES AND COMPETING RISK MODELS] Final Report
Joseph C. Gardiner Dec. 1985 22 p
(Contract N00014-79-C-0522)
(AD-A162703; AD-E301866) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research performed on this contract addressed statistical methodologies that would be appropriate in censored survival analyses and competing risks models. Both general parametric and nonparametric models were considered. The problems of efficient estimation of parameters of the underlying failure time distribution were addressed when the data may only be partly observable due to the presence of censorship. The methodology developed permits costs associated with monitoring of experimentation and of recruitment of units to be incorporated into the basic infrastructure leading to the description and properties of optimal procedures that minimize overall expected cost. These optimal designs are inherently sequential in nature, in that the optimal stopping time or sample size is solely determined by the observed information gathered by experimeter. GRA

N86-22246# North Carolina Univ., Chapel Hill. Chapel Hill Dept. of Statistics.
M-ESTIMATION FOR DISCRETE DATA. ASYMPTOTIC DISTRIBUTION THEORY AND IMPLICATIONS
Douglas G. Simpson, Raymond J. Carroll, and David Ruppert Oct.

1985 22 p Prepared in cooperation with Illinois Univ., Urbana. Dept. of Statistics
(Contract F49620-85-C-0144; Grant NSF DMS-84-00602)
(AD-A162779; AFOSR-85-1115TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The asymptotic distribution of an M-estimator is studied when the underlying distribution is discrete. Asymptotic normality is shown to hold quite generally within the assumed parametric family. When the specification of the model is inexact, however, it is demonstrated that an M-estimator with a non-smooth score function, e.g., a Huber estimator, has a non-normal limiting distribution at certain distributions, resulting in unstable inference in the neighborhood of such distributions. Consequently, smooth score functions are proposed for discrete data. Author (GRA)

N86-22247# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.
ISOTONIC RULES FOR SELECTING GOOD TRUNCATED EXPONENTIAL POPULATIONS
TaChen Liang Nov. 1985 30 p
(Contract N00014-84-C-0167)
(AD-A162790; TR-85-32) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of selecting truncated exponential populations better than a control under an ordering prior is studied. Based on some prior information, it is reasonable to set lower bounds for the concerned parameters. Through this consideration, and isotonic selection rule is proposed. This selection rule always satisfies the requirement that the probability of a correct selection is at least equal to some prespecified value p:. A criterion is proposed to evaluate the performance of the selection rules. Simulation results indicate that this rule always performs better than some other earlier existing isotonic selection rules. Author (GRA)

N86-22248# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Hauptabteilung Mathematik and Information.
THE STATISTICAL ANALYSIS PROGRAM PACKAGE (SAPP): A SPECIAL DATA ANALYSIS PROGRAM Final Report [SAPP: EIN SPEZIELLES DATENANALYSESYSTEM (KURZFASSUNG)]
Franz Helmreich Jul. 1985 18 p refs In GERMAN; ENGLISH summary
(OEFZS-4326; MI-83/85) Avail: NTIS HC A02/MF A01

The Statistical Analysis Program Package is a methodical preparation of statistical test procedures (descriptive statistics, correlation, regression, variance, covariance, factor and cluster analysis) in relation with an efficient data management. It is a flexible, menu-based system composed of data entry error-monitoring and explanation modules for solution of statistical biomedical data. The system allows synthetic collection of result formulas for direct utilization. Author (ESA)

N86-22249# Oxford Univ. (England). Dept. of Engineering Science.
NORMALITY SCALING AND EIGENVALUE INCLUSION REGIONS
R. F. Harrison and B. Kouvaritakis 1985 34 p refs
(OUEL-1594/85) Avail: NTIS HC A03/MF A01

The normal approximations approach to robust stability analysis is extended to utilize the eigenvalue preserving operation of similarity scaling. In the case of 2x2 systems, the scaling which minimizes the spread of the numerical range of the nominal system is obtained. It is identical to that obtained by minimizing the condition number of the system. It is also identical to the Perron scaling. In the general, mxm, case it is not possible to optimize the normal approximation but the results when m=2 suggest that any of the above criteria offer a (suboptimal) improvement. The Perron scaling is particularly useful due to its explicit nature. The other scaling matrices must be obtained by numerical means. Because no explicit account of the structure of the perturbation on the system is taken when calculating the scaling matrix, scaling may have unpredictable effects on the eigenvalue inclusion regions, even though the normal approximations are always improved. However, the improved condition of the approximated system should offset detrimental effects. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N86-22250*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN OPTIMAL REPARTITIONING DECISION POLICY Final Report
David M. Nicol and Paul F. Reynolds, Jr. (Virginia Univ.) Feb. 1986 19 p refs Submitted for publication
(Contract NAS1-17070; NAS1-18107)
(NASA-CR-178035; ICASE-86-7; NAS 1.26:178035) Avail: NTIS HC A02/MF A01 CSCL 12B

A central problem to parallel processing is the determination of an effective partitioning of workload to processors. The effectiveness of any given partition is dependent on the stochastic nature of the workload. The problem of determining when and if the stochastic behavior of the workload has changed enough to warrant the calculation of a new partition is treated. The problem is modeled as a Markov decision process, and an optimal decision policy is derived. Quantification of this policy is usually intractable. A heuristic policy which performs nearly optimally is investigated empirically. The results suggest that the detection of change is the predominant issue in this problem. Author

N86-22251*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
A HIERARCHICAL APPROACH TO RELIABILITY MODELING OF FAULT-TOLERANT SYSTEMS M.S. Thesis
William Elting Gossman Jan. 1986 81 p refs
(Contract NAS9-16023)
(NASA-CR-176654; NAS 1.26:176654; CSDL-T-897) Avail: NTIS HC A05/MF A01 CSCL 12B

A methodology for performing fault tolerant system reliability analysis is presented. The method decomposes a system into its subsystems, evaluates vent rates derived from the subsystem's conditional state probability vector and incorporates those results into a hierarchical Markov model of the system. This is done in a manner that addresses failure sequence dependence associated with the system's redundancy management strategy. The method is derived for application to a specific system definition. Results are presented that compare the hierarchical model's unreliability prediction to that of a more complicated tandard Markov model of the system. The results for the example given indicate that the hierarchical method predicts system unreliability to a desirable level of accuracy while achieving significant computational savings relative to component level Markov model of the system. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-22252# Georgia Univ., Athens. Dept. of Chemistry.
THE ROLE OF THE TOPOLOGICAL DISTANCE MATRIX IN CHEMISTRY
D. H. Rouvray 16 Dec. 1985 14 p
(Contract N00014-85-K-0365)
(AD-A162523; TR-11) Avail: NTIS HC A02/MF A01 CSCL 12/1

The mathematical properties of the topological distance matrix are briefly surveyed and the numerous applications of this matrix to various branches of chemistry are then described. A detailed discussion is devoted to the Wiener index, defined as one half the sum of the entries in the distance matrix. This index has proved to be one of the most valuable topological indices in several different chemical contexts. GRA

N86-22253# Tilburg Univ. (Netherlands). Dept. of Economics.
ON MEASURES OF NONNORMALITY OF MATRICES
L. Elsner (Bielefeld Univ., West Germany) and M. H. C. Paardekooper Dec. 1984 29 p refs
(FEW-167) Avail: NTIS HC A03/MF A01

Nine measures of nonnormality of matrices and their interactions are discussed. The fact that a matrix is normal if and only if the matrix has a measure zero for each nonnegative measure is proved. This method is related to the behavior of the eigenvalue algorithms for normal and nonnormal matrices. Measures for numerical analysis of eigenvalue algorithms are introduced.
Author (ESA)

N86-22120# Center for Mathematics and Computer Science, Amsterdam (Netherlands).
RECENT PROGRESS ON THE NUMERICAL VERIFICATION OF THE RIEMANN HYPOTHESIS
J. vandeLune and H. J. J. teRiele *In its* CWI Newsletter, No. 2, March 1984 Mar. 1984 p 35-37 refs (For primary document see N86-22117 12-59)
Avail: NTIS HC A04/MF A01

N86-22123# Amsterdam Univ. (Netherlands).
SET THEORY AND TOPOLOGY
Jan vanMill *In* CWI CWI Newsletter, No. 7, June 1985 Jun. 1985 p 10-14 refs (For primary document see N86-22121 12-59)
Avail: NTIS HC A03/MF A01

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-22254# Joint Publications Research Service, Arlington, Va.
USSR REPORT: PHYSICS AND MATHEMATICS Abstracts Only
5 Feb. 1986 69 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-86-003) Avail: NTIS HC A04

Numerous topics in physics and mathematics are discussed. Laser modulation, numerical analysis on nonequilibrium flow about an airfoil in thin shock layer approximation, the kinetics of molecular nitrogen, and the nonlinear properties of superconducting point contacts are among the topics discussed. For individual titles, see N86-22255 through N86-22299.

N86-22255# Joint Publications Research Service, Arlington, Va.
BRANCHES OF ACOUSTIC OSCILLATIONS OF A GAS INTERACTING IN RESONANCE WITH LIGHT Abstract Only **c71**
F. Kh. Gelmukhanov and L. V. Ilichev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 1 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Theoreticheskoy Fiziki (Moscow, USSR), v. 88, no. 3, Mar. 1985 p 733-740 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The influence of light pressure, light-induced drift, and related effects on branches of acoustic oscillations of a gas in a radiation field is investigated. The role of light pressure in forming the acoustic oscillation spectrum is investigated in pure form by disregarding light induced drift and related effects. The effect of light induced drift on oscillations is then investigated by disregarding the recoil effect. The propagation frequencies and velocities of acoustic oscillations are estimated. It is found that the frequency of acoustic oscillations caused by the recoil effect is 1,000 sec(-1). The radiation-induced pressure tensor and heat flux result in two additional oscillation branches.
Author

N86-22256# Joint Publications Research Service, Arlington, Va.
MODULATION OF IR LASERS BY SEMICONDUCTING PLASMA Abstract Only **c76**
L. I. Berezhinskiy and A. I. Liptuga *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 2 Transl. into ENGLISH from Kvantovaya Elektronika (Kiev, USSR), v. 27, Oct. 1984 p 50-54 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The properties are investigated of a semiconductor modulator employing a nonequilibrium plasma stimulated by hybrid electrical and magnetic fields. An InSb crystal is investigated in hybrid fields at 195 and 300 K, and exhibits the voltage-current characteristics of a rectifier diode, indicating an unsteady total number of carriers in the crystal. It is found that significant surface enrichment can be achieved by using hybrid fields. It is found possible to modulate the radiation with a modulation coefficient the order of 80% and speed of 0.00000001 seconds by controlling the concentration of the electron-hole plasma on an InSb surface. The region of wavelengths that can be modulated is determined by the limits of variation of the carrier concentration on the reflecting facet of the crystal. The method provides better speed, lower electrical field control voltages, and a wider spectral range of wavelengths that can be modulated than do other approaches.
Author

N86-22257# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFECT OF REPEATED LASER IRRADIATION ON ACTIVE LASER GLASSES Abstract Only **c27**
R. I. Andreeva, A. P. Kalagin, V. N. Nikolaev, and G. N. Toropkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 3 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 1, Jan. 1985 p 14-17 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The occurrence and principles of defect accumulation in glasses with different bases are investigated. Experimental data on the time elapsed prior to breakdown for different laser radiation densities is analyzed. A single-mode single-frequency Q-modulated laser was employed to irradiate silicate and phosphate Nd3+ activated glasses. The accumulation and breakdown processes were found to occur on defects with different laser defect thresholds. The characteristics of the phosphate and silicate-based glasses examined are indistinguishable. The time elapsed prior to breakdown in glass subjected to repeated laser radiation is described by a log-normal distribution.
Author

N86-22258# Joint Publications Research Service, Arlington, Va.
NUMERICAL ANALYSIS OF NONEQUILIBRIUM FLOW ABOUT AIRFOIL IN THIN SHOCK LAYER APPROXIMATION Abstract Only **c02**
V. N. Golubkin and V. V. Negoda *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 5 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 25, no. 4, Apr. 1985 p 599-608 Original language document was announced in IAA as A85-33593 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

An efficient method is presented for solving nonlinear equations for a thin nonequilibrium shock layer on a low-aspect-ratio wing in hypersonic gas flow. The effect of the nonequilibrium of three-dimensional flow on the shape of the shock wave attached to the leading edge, pressure distribution, and the force and moment characteristics of the wing is discussed. Results of numerical calculations are presented.
V.L.

N86-22259# Joint Publications Research Service, Arlington, Va.
NUMERICAL SOLUTION OF PROBLEM ON DECAY OF HIGH-TEMPERATURE REGION OF RADIATING GAS WITH VARIOUS INITIAL INTERNAL ENERGY DISTRIBUTIONS Abstract Only **c34**
V. P. Korobeynikov, B. V. Putyatin, and A. K. Sharipov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 6 Transl. into ENGLISH from Doklady Akademii Nauk Tadzhikskoy SSR (Dushanbe, USSR), v. 27, no. 11, Nov. 1984 p 633-636 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The decay of the high temperature region of a radiating gas is investigated as a problem which models the process independently of the nature of the energy release source. Radiation

gas dynamic equations are integrated numerically. Model step functions of the thermodynamic parameters are used for the coefficient of absorption and the radiation source function. Examples of the space-time distribution of the gas characteristics are presented. It is found analytically that the solutions to the problem for different types of initial internal energy distributions are practically the same when the dimensions of the heat release region are small enough. The role of the initial perturbation forms on the nature of the solution is examined. Author

N86-22260# Joint Publications Research Service, Arlington, Va.
SHOCKWAVE PROPAGATION IN LOW-TEMPERATURE CARBON PLASMA Abstract Only c34
A. M. Galkin, N. N. Sysoev, and F. V. Shugaev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 7 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta Seriya 3: Fizika Astronomiya (Moscow, USSR), v. 26, no. 2, Mar. - Apr. 1985 p 77-80 Original language document was announced in IAA as A85-37374 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The propagation of plane and spherical shock waves through the low-temperature plasma of a laser jet was investigated experimentally using a shock tube of a square (28.5 x 28.5 mm) cross-section. The Mach number of the nonturbulent shock wave varied from 1.2 to 6; the initial pressure in the test section of the shock tube was 5 to 50 kPa. It is found that in a plasma, the shock wave front breaks down into layers and then disappears. V.L. (IAA)

N86-22261# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF EFFICIENCY OF UTILIZING ALPHA-RADIATION TO PRE-IONIZE THE WORKING MIXTURE IN GAS DISCHARGE LASERS AND AMPLIFIERS Abstract Only c36
N. G. Basov, V. A. Danilychev, V. N. Koterov, S. G. Perlov, T. M. Plyshevskaya, and A. M. Soroka *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 8 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 281, no. 5, Apr. 1985 p 1106-1110 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The spatial distribution of the laser mixture ionization rate by alpha-particles from a radioactive isotope layer is investigated. Conditions are identified under which the homogeneity of ionization by alpha-particles is as good as for electron ionization. The possibility of using electroionization excitation, in which the conductivity of the discharge plasma is maintained only by the external ionization source, is discussed. A discharge interval formed by two flat electrodes is analyzed as an example, assuming that the alpha-radioactive preparate is applied directly to both electrodes. The volumetric frequency of the gas ionization achieved near the electrodes, and the degree of inhomogeneity of the ionization frequency, are investigated as a function of the width of the discharge interval. The volumetric ionization frequency must be ncreased by approximately two orders of magnitude in order to employ electrode ionization excitation, which can be done by using alpha-radioactive isotopes with lifetimes of approximately one year. Author

N86-22262# Joint Publications Research Service, Arlington, Va.
FUTURE POSSIBILITIES OF FREE-ELECTRON LASER Abstract Only c36
A. N. Lebedev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 9 Transl. into ENGLISH from Priroda (Moscow, USSR), no. 9, Sep. 1984 p 28-36 Original language document was announced in IAA as A85-14873 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The principle of operation of free-electron lasers, their limitations, and the physical and engineering problems involved in the implementation of such lasers are reviewed. The discussion covers the principle of synchronism, induced emission of a system of electrons, undulators, and the feedback problem. Attention is also given to the efficiency of free-electron lasers and acceleration problems. V.L. (IAA)

N86-22263# Joint Publications Research Service, Arlington, Va.
NEW FINDINGS ON CREATION OF POWERFUL TUNABLE SUBPICOSECOND SOLID-STATE LASERS Abstract Only c36
V. Vasilyauskas, A. Piskarskas, V. Sirutkaitis, A. Stabinis, and A. Yankauskas *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 10 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Fizicheskaya (Moscow, USSR), v. 49, no. 3, Mar. 1985 p 493-499 Original language document was announced in IAA as A85-31861 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Pulse compression during the parametric interaction of light pulses in media with a quadratic nonlinearity under conditions of strong energy exchange and dispersive spread is investigated numerically. Experimental results are then presented on the phase modulation of the emission of superluminescent picosecond parametric light generators, in particular, a parametric light generator based on a LiNBO3 crystal. V.L. (IAA)

N86-22264# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ELECTROMAGNETIC WAVE AND WIGGLER FIELDS INHOMOGENEITY ON A FREE-ELECTRON LASER Abstract Only c36
A. V. Serov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 11 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 516-521 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The influence of cross-sectional wave and undulator fields inhomogeneity on the particle dynamics and gain of free-electron lasers is investigated. A new operating mode is examined in which either the transverse velocities of the beam particles, or their transverse coordinates, are modulated to the frequency of the amplified wave prior to injection into the undulator. The efficiency of electron energy conversion to radiation is investigated when the initial conditions for electron injection into the laser undulator are modulated. Modulation of the initial injection conditions makes it possible to exploit the value difference between the fields interacting with the accelerated and retarded particles, in order to increase average beam energy losses. Author

N86-22265# Joint Publications Research Service, Arlington, Va.
EFFECT OF PULSE DEPENDENT DISCHARGE ON RELAXING GAS FLOW Abstract Only c36
V. A. Levin, V. V. Netesov, and Yu. V. Tunik *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 12 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 540-545 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

A dependent-discharge CO2 electroionization laser is examined. A system of gas dynamic equations is augmented with vibrational kinetic equations (equations that allow for the interaction of the discharge with a gas stream) and an equation for the radiation intensity. The influence of gas dynamic processes on the characteristics of an electric discharge CO2 laser is examined on the basis of a one-dimensional model. The influence of gas dynamic perturbations occurring in the discharge chamber, and of heating of the medium, on the output power in the pulsed and pulse-periodic modes is investigated analytically. The optimum pulse repetition frequency is found for different energy contributions to the discharge. Author

N86-22266# Joint Publications Research Service, Arlington, Va.
IGLAN-3 MULTIBEAM CW GAS-DISCHARGE CO2 LASER Abstract Only c36
G. I. Kozlov and V. A. Kuznetsov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 13 Transl. into ENGLISH from Kvantovaya Iektronika (Moscow, USSR), v. 12,

no. 3(153), Mar. 1985 p 553-562 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04/MF A01

The IGLAN-3 multibeam laser, a high-power multibeam gas discharge diffusion-cooled system, is examined in detail. The optimum operating conditions are determined by changing sequentially the governing parameters - the composition of the laser mixture, the gas pressure, and the discharge characteristics. The optical properties of the active medium are investigated. The divergence of the output radiation and the intensity distribution in the focused beam are measured. Although the intensity is somewhat irregular over the cross-section of the beam since the different channels operate slightly differently, the intensity distribution is found to be sufficient for technological heat-treatment, surface doping, melting, and other processes. Author

N86-22267# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF ELECTROIONIZATION PULSED CARBON DIOXIDE ISOTOPE OUTPUT CHARACTERISTICS Abstract Only c36
S. V. Bardakovskiy, N. M. Bladimirova, P. V. Sarubin, V. G. Lyakishev, A. A. Kholodilov, V. M. Tsarev, and N. V. Cheburkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 14 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 622-624 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The efficiency and spectral composition of radiation from a pulsed electroionization laser operating at atmospheric pressure in which the working mixture contains the carbon dioxide isotopes 12C16O2, 13C16O2, and 12C18O2 are investigated experimentally. Lasing with 13C16O2 occurs simultaneously on five vibrational-rotational transistions, while with 12C18O2 it occurs on one transition. The operating efficiency is close to that of an ordinary 12C16O2 laser, with the energy contribution determined by the presence of impurities in the working mixture. Author

N86-22268# Joint Publications Research Service, Arlington, Va.
HYSTERESIS EFFECTS IN Ar+ LASER WITH NONLINEAR ABSORBER IN THE CAVITY Abstract Only c36
Kh. G. Gafurov and D. P. Krindach *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 15 Transl. into ENGLISH from Kvantovaya Elektronika Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 625-627 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The nature of hysteresis phenomena in the lasing power near the threshold is discussed for a passive mode-locked Ar+ laser. The system in question employs a GL-301 gas discharge tube as the amplifying element, and a tube with a 15-cm discharge length as the absorbing element. Hysteresis is to be found to be associated essentially with those active medium saturated processes that govern passive mode-locked laser with the same characteristic time relationship as the Ar+ laser. Author

N86-22269# Joint Publications Research Service, Arlington, Va.
LASING OF XeCl, Xe AND KrF EXCIMER MOLECULES IN TWO-COMPONENT MIXTURES Abstract Only c36
N. G. Zubrilin, A. I. Milanich, M. P. Chernomorets, and S. V. Yurchuk *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 16 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 643-644 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Fast-discharge lasing in dual-component mixtures is achieved in a system with a 30-cm chamber and external cavity. Lasing is obtained on XeCl, XeF, and KrF molecules in mixtures with no buffer gas. The investigation of lasing and dual-component mixtures excited by a fast discharge makes it possible to establish the parameters of the processes which lead to the formation of excimer molecules and to understand better the role of the buffer gas in the active medium of excimer lasers. Author

N86-22270# Joint Publications Research Service, Arlington, Va.
HIGH-POWER CO2 ELECTRIC DISCHARGE LASER WITH EASILY IONIZED SUBSTANCES ADDED Abstract Only c36
V. V. Apollonov, Yu. M. Vaskovskiy, M. I. Zhavoronkov, A. M. Prokhorov, R. Ye. Rovinskiy, V. Ye. Rogalin, N. D. Ustinov, K. N. Firsov, I. S. Tsenina, and V. A. Yamshchikov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 17 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 5-9 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Optimization of the parameters of a transverse-discharge CO2 laser as described in a previous study by the authors is investigated. The output characteristics of the laser are optimized by investigating the radiated energy as a function of the length of the active medium as well as the coefficient of reflection of the exit mirror. It is found that by selecting the easily ionized substances and pumping mode properly, and optimizing the cavity, it is possible to obtain efficiencies and unit energy yields from an externally-driven O2 laser that are as good as those of corresponding electroionization systems. The laser used in the study employs an extremely compact electrode design, and requires no low-inductance capacitors in the pumping circuit. Specific output energy of 51 J/1 and electric energy-to-light conversion efficiency of 22% are achieved. Author

N86-22271# Joint Publications Research Service, Arlington, Va.
GENERATION OF PICOSECOND PULSES IN MONOPULSE-PUMPED DYE LASERS Abstract Only c36
K. D. Yegorov, V. M. Petnikova, S. A. Pleshanov, and V. V. Shuvalov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 18 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 41-47 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Stimulated emission of radiation by thin cavity cuvettes and laser systems consisting of such a cuvette and an external dispersion cavity is investigated. Four different stages are identified in the development of stimulated emission: the formation of inverse population, linear amplification of spontaneous noise, nonlinear amplification with the formation of a time pulse envelope, and decay of the residual inverse population. An experimental setup employing a YAG passive Q-locked laser with a repetition frequency less than 3 Hz is described. The dynamics of stimulated emission was shown to agree exactly with the results of the numerical experiment. Spectrally limited pulses 3.5 picoseconds long are produced. Author

N86-22272# Joint Publications Research Service, Arlington, Va.
SPATIAL, TEMPORAL AND ENERGY CHARACTERISTICS OF COPPER-VAPOR LASER RADIATION Abstract Only c36
V. P. Belyayev, V. V. Zubov, A. A. Isayev, N. A. Lyabin, Yu. F. Sobolyev, and A. D. Chursin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 19 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 74-79 Original language document was announced in IAA as A85-26231 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

An analysis is made of the radiation characteristics of a copper-vapor laser in the superradiance regime with stable (planar-spherical) and unstable (telescopic) resonators. The total mean radiation power with a planar-spherical resonator was 26 W(52 percent at the green line), including the 3-W background radiation. With a telescopic resonator with a gain of = 200, the total mean radiation power was 18 W, including 10 W for the beam with diffraction divergence. An increase of the radiation power in the diffraction beam to 30-35 W was achieved through the use of a similar active element as an amplifier. L.T. (IAA)

N86-22273# Joint Publications Research Service, Arlington, Va.
COMPARATIVE ANALYSIS OF OPTICALLY AND ELECTRONICALLY PUMPED BROADBAND EXCIMER LASERS Abstract

Only **c36**
G. Marovski, A. V. Kanayev, L. D. Mikheyev, and D. B. Stavroskiy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 20 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 180-183 Original language document was announced in IAA as A85-26240 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

A comparison is made of optically pumped and electro-beam-pumped lasers based on three-atom excimers and C-A transition of the XeF excimer. The parameters under consideration are the small-signal gain, absorption losses, and energy characteristics. The electron-beam-pumped laser exhibited gain factors larger by an order of magnitude than those observed in the optically pumped laser, making it theoretically possible to maintain a periodic-pulse regime with a much higher pulse repetition rate. The optically pumped laser, however, exhibited lower absorption.
L.T. (IAA)

N86-22274# Joint Publications Research Service, Arlington, Va.
SINGLE-FREQUENCY CW LASING IN INJECTION LASER BASED ON TERRACED HETEROSTRUCTURE WITH EXTERNAL DISPERSION CAVITY Abstract Only **c36**
A. P. Bogatov, I. C. Goldobin, P. G. Yeliseyev, O. G. Okhotnikov, G. T. Pak, M. P. Rakhvalskiy, Ye. G. Faynboym, and K. A. Khayretdinov *In its* USSR Report: Physics and Mathematics (JPRS-UPM86-003) 5 Feb. 1986 p 21 Transl. into ENGLISH from KVantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 162-164 Original language document was announced in IAA as A85-26237 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

A laser diode with a terrace-type active region is used as an active medium in a laser with external dispersion resonator to obtain CW single-frequency radiation of 35 mW at room temperature. It is noted that no multimode oscillation mechanism associated with deformation of the electronic spectrum in the semiconductor was observed up to intensities of 1.7 x 10 to the 7th W/sq cm. due to the relatively high output power (tens of mW), narrow oscillation line, and spectral tunability, this class of lasers is suggested to be suitable for application in nonlinear spectroscopy of superhigh resolution and coherent optical communications.
L.T. (IAA)

N86-22275# Joint Publications Research Service, Arlington, Va.
WAVELENGTH SWITCHING IN COPPER-VAPOR LASERS Abstract Only **c36**
S. A. Zenchenko, V. I. Ivanov, I. A. Malevich, and S. F. Shulekin N its USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 22 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 196-197 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The preliminary results of an investigation of the emission modes of copper vapor lasers employing an intra-cavity anisotropic filter consisting of polarization filters with parallel transmission axes that are separated by crystalline quartz plates set at the Brewster angle are presented. The use of this birefringent filter for switching the lasing wavelength is described. It is found that the use of a simple birefringent filter makes it possible to switch wavelengths, which expands the area of application of copper vapor lasers. Eliminating the exit polarization filter can also make it possible to control the polarization characteristics of the radiation. Author

N86-22276# Joint Publications Research Service, Arlington, Va.
H2/F2 CHEMICAL LASER INITIATED BY EXCIMER FLASHLAMP Abstract Only **c36**
Ye. V. Gordon, V. I. Matyushenko, V. S. Pavlenko, and V. D. Sizov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 23 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 220-223 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The results of an investigation of a H2/F2 chemical laser built by the authors that is initiated by an excimer flashlamp are discussed. The lasing energy of the HF laser and the UV luminescence of the excimer flashlamp are investigated as a function of the composition and pressure of the mixture in the lamp chamber and the charge voltage of the power supply. Suppression of the superluminscence of the flashlamp, which is necessary for the chemical laser to work, is discussed. The technical efficiency of the flashlamp is estimated at approximately 5%, which is 10 times greater than that of the excimer laser on which it is based. The possibility of increasing the efficiency of chemical lasers initiated by achieving a mode in which the formation of the excimer molecules and vibrational excited HF molecules coincides in space is discussed. Author

N86-22277# Joint Publications Research Service, Arlington, Va.
YAG:Er3+ CROSS-RELAXATION LASER Thesis - USSR Academy of Sciences, 1984 Abstract Only **c36**
Vladimir Andreyevich Lobachev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 24 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The ion-ion tranfer of excitation energy (cross-relaxation) in (Y, Er)3Al5O12 crystals is investigated experimentally. The influence of cross-relaxation on inversion formation and the lasing of a YAG:Er(3+) laser is investigated. The excitation conditions and modes for a YAG:Er(3+) laser are selected, and the lasing characteristics are studied. The mechanisms underlying the formation of inverse population of the 4 I 11/2 - 4 I ion of ER(3+) in yttrium-aluminum garnet crystals is explained. Relaxation of the excitation nergy from the S sub 3/2 level is found to be governed by a cross-relaxation mechanism. Kinetic equations comosed to allow for cross-relaxation processes are used to analyze laser operation. A YAG:Er(3+) cross-relaxation laser with good energy characteristics with free lasing efficiency of about 1.5% and differential efficiency of about 3%, producing output energy of up to 6 J, is described. Author

N86-22278# Joint Publications Research Service, Arlington, Va.
NONEQUILIBRIUM EFFECTS AND STRUCTURE OF X-RAY LINES IN TOKAMAK PLASMA Abstract Only **c75**
V. G. Gontis and V. S. Lisitsa *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 25-26 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 438-492 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The sensitivity of X-ray spectra to a number of typical non-equilibrium effects occurring in modern tokamaks is examined. Experimental data from the T-10 and ST tokamaks are cited to illustrate the degree of deviation from coronal equilibrium. The analysis exploits recent atomic data for radiation and autoionization line widths; standard semiempirical formulas are used to calculate the rates of collision processes. Ion diffusion and impurity distribution by degrees of ionization are investigated. The sensitivity of K radiation to electron nonequilibrium and ion charge exchange is examined. Author

N86-22279# Joint Publications Research Service, Arlington, Va.
STUDY OF THE KINETICS OF MOLECULAR NITROGEN BY THE METHOD OF WIDE-BAND COHERENT ANTISTOKES SCATTERING OF LIGHT Abstract Only **c74**
A. A. Devyatov, S. A. Dolenko, and N. N. Roy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 27 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 281, no. 6, Apr. 1985 p 1355-1359 Original language document was announced in IAA as A85-35878 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The broadband version of coherent anti-Stokes Raman spectroscopy (CARS) has been used for probing nitrogen atomis vibrationally excited by a self-maintained pulsed discharge. New data on the form of the vibrational population distribution function in post-discharge nitrogen are presented, and the kinetics of the

function is investigated. The sensitivity limit of the CARS spectrometer used in the study is 10 to the 17th nitrogen molecules in the ground state per cu cm. V.L. (IAA)

N86-22280# Joint Publications Research Service, Arlington, Va.
NONLINEAR OPTICAL SPECTROSCOPY OF PHONON POLARITONS Thesis - USSR Academy of Sciences Abstract Only **c74**
Yuriy Nikolayevich Polivanov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 28 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The physical mechanisms, singularities, and general principles of Raman scattering, coherent anti-Stokes scattering, and two-photon combination scattering of light on polaritons are established and investigated experimentally. New spectroscopic methods are developed based on these processes or solving problems in quantum electronics and solid state physics. It is found that two-photon scattering can be used to investigate polaritons of the upper dispersion branches in optically isotropic media. The characteristics and regularities of the scattering spectra of uniaxial and bi-axial polyatomic crystals are interpreted. The singularities occuring in the spectra of Raman scattered light on polaritons are studied experimentally. The interference of direct four-photon and cascaded three-photon processes in the anti-Stokes spectra of crystals without centers of symmetry is detected. Author

N86-22281# Joint Publications Research Service, Arlington, Va.
DIAGNOSIS OF POPULATIONS AND RELAXATION PROCESSES OF VIBRATIONAL AND ROTATIONAL STATES OF MOLEUCLES IN GASES BY COHERENT ANTI-STOKES SCATTERING SPECTROSCOPY Thesis - USSR Academiy of Sciences Abstract Only **c74**
Viktor Immanuilovich Fabelinskiy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 29 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Coherent anti-Stokes scattering spectroscopy is employed to investigate spectral line contours and to measures the rotational relaxation times in molecular gases by measuring line widths as a function of pressure. The molecule distribution functions are investigated at vibrational and rotational states in non-equilibrium and equilibrium excited gas systems; the influence of the gas temperature and pressure on the form of the coherent anti-Stokes spectra is studied. The velocity constants of the intra-mode resonant exchange of vibrational energy in gases are measured by the dynamics of the line intensities in the Stokes spectra. The gases in question, acetylene and nitrogen, are investigated by means of a pulse spectrometer with resolution of 0.2 cm(-1) and sensitivity of approximately 10 14 molecules per cubic centimeter. Author

N86-22282# Joint Publications Research Service, Arlington, Va.
INTENSE BEAMS OF COLD ATOMS FOR LASER SPECTROSCOPY Abstract Only **c74**
V. I. Balykin, V. C. Letokhov, V. G. Minogin, and A. I. Sidorov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 30 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Fizicheskaya (Moscow, USSR), vol. 49, no. 3, Mar.1985 p 479-486 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Longitudinal cooling of beams of atoms by extended interaction with strong laser radiation is examined. An experimental set-up is described in which a narrow beam of atoms is irradiated by a counter-propagating light beam in resonance with the 3(2)S sub 1/2 -3(2)P sub 3/2 transition of the sodium atom. The longitudinal velocity distribution is recorded by a second laser probe beam which intersects the atom beam at a slight angle at the end of the zone of interaction with the strong beam. Optimum conditions are defined for the configuration of the laser beam, and for the time and length of interaction, to ensure a low effective atom beam temperature with high intensity. Transverse cooling of atom beams by radiation collimation is described. It is estimated that the atom density can be increased significantly, and atom beams with the smallest possible transverse temperature can be obtained, by using a large collimator or a retarded atom beam. The ability to obtain intense atom beams at low temperature makes it possible to use cold atoms in precision spectroscopy. Author

N86-22283# Joint Publications Research Service, Arlington, Va.
DIFFRACTION EFFICIENCY OF HOLOGRAPHIC GRATINGS WITH SYMMETRICAL PROFILES Abstract Only **c74**
L. A. Dmitrieva, I. V. Golubenko, and G. M. Savitskin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 31 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 1, Jan. 1985 p 4-6 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The diffraction properties of holographic reflecting diffraction gratings are examined. An approximation for infinite conductivity is used based on a sufficiently accurate and simple numerical method which uses integral equations to solve problems of electromagnetic waveguide splitting by a reflecting grating of arbitrary profile. The optimum channel depth for different profiles is analyzed. The preferable profile for different fixed channel depth and the preferable symmetrical profile for obtaining the best efficiency are studied. The diffraction efficiency is examined as a function of the light wavelength, with one of the diffraction harmonics propagating in the opposite direction of the incident light. The best diffraction efficiency is obtained by using a grating profile with elongated peaks, smooth bottoms, and channel depth not exceeding 0.4. Profiles with smooth peaks are found to be superior to pointed peaks for h/d=0.2. Author

N86-22284# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF OPTICAL INHOMOGENEITY OF CYLINDRICAL BODIES BY LIGHT BEAM DEFLECTION Abstract Only **c74**
Kh. K. Aben, S. I. Idnurm, Yu. I. Iozepson, M. S. Kaplan, and S. A. Malinovskaya *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 32 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 1, Jan. 1985 p 7-9 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

A simple method is examined for studying the optical inhomogeneity of cylindrical bodies based on measuring the deflection of a laser beam. The radial distribution and axial gradient of the index of refraction are found. A method is proposed for interpreting experimental data when a caustic appears. The concepts of isotropic (scalar) and anisotropic (tensor) optical inhomogeneities are introduced in order to distinguish between optical inhomoeneity with and without birefringence. The optical inhomogeneity of a polymethylmethacrylate cylinder is investgated. Author

N86-22285# Joint Publications Research Service, Arlington, Va.
ENHANCING EFFICIENCY OF ATOM IONIZATION BY PULSED PERIODIC LASERS Abstract Only **c74**
S. V. Andreev, V. I. Minshin, and S. K. Sekatskiy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 33 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 611-614 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The possibility is investigated of improving particle trapping efficiency by laser resonant atom photionization using pulsed laser radiation with a high relative pulse duration. Photoionization of atoms in a closed cavity by laser radiation input to the cavity through a small opening in the wall is examined. Each atom within the cavity either falls within the zone of the laser beam when radiation occurs and is ionized, or it exits through the opening in the cavity wall and is lost. The cavity geometry can be selected to provide capture efficiency exceeding 50% for real radiation parameters (pulse duration up to 15 nsec, and 10 kHz repetition

frequency). This method may provide highly effective for ionizing atoms through Rydberg states, in which case the extracting voltage can also serve to ionize atoms already excited to higher Rydberg states. Author

N86-22286# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF COMPENSATING SMALL-SCALE INHOMOGENEITIES BY A ZERNIKE CELL Abstract Only **c74**
V. Ye. Sherstebitov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 34 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 91-95 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

A wavefront conjugating mirror based on a Zernicke cell containing no nonlinear elements is examined theoretically. The scheme incorporates a flat mirror and two identical co-focal objectives that implement the Zernike phase contrast method except that the radiation passes twice: once in each direction. The wavefront conjugation distortions are found to be small for the B variation range of interest if the ratio of the characteristics beam dimensions at the input to that of the period of spatial phase fluctuations of the wavefront is greater than 3 to 3.5. This scheme for correcting small scale distortions is advantageous in that the coefficient of reflection of the wavefront conjugation mirror is near unity, and is independent of the operating mode laser (continuously repulsed) and of the radiation spectral composition to some extent. Author

N86-22287# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF UNIVERSAL INTRAMOLECULAR INTERACTIONS ON LASER RADIATION FROM OXAZINE 17 Abstract Only **c74**
N. V. Korolkova, N. V. Kurokhtin, and B. M. Uzhinov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 35 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 96-98 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

This study investigates the influence of intramolecular actions of a universal nature on the luminescence and laser emission of oxazine 17 (a highly efficient working substances that lases in the 600 to 700 nm region) to identify the conditions under which maximum lasing efficiency can be achieved. Oxazine 17 solutions in polar aprotic solvents are found to provide the test lasing efficiency. The lasing and fluorescence spectral maxima in polar solvents are practically identical; the wavelengths of the former are longer in nonpolar solvents. Author

N86-22288# Joint Publications Research Service, Arlington, Va.
RADIATION FOCUSING BY PRISM RASTER Abstract Only **c74**
A. S. Dementyev and D. P. Domarkene *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 36 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 197-201 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

This study describes the focusing properties of a prism raster, which consists of two crossed sets of prisms having the profile of a polyhedron scribed in a circle. The focusing properties are investigated with the help of the Rayleigh approximation. The transmission function of the raster is derived by approximating the arc of the circle by the corresponding polyhedron. Hot spots, or intensity spikes, are detected in the radiation focused by the prism raster that result from interfernce of the coherent radiation that is diffracted on different prisms. This means that the use of prism rasters alone for highly coherent radiation is insufficient for obtaining near-uniform intensity distribution in the focal plane. Author

N86-22289# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF FLUORESCENCE KINETICS OF DYES BY PARAMETRIC FREQUENCY CONVERSION Abstract Only **c74**
S. A. Pleshanov and V. V. Shuvalov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 37 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta Seriya 3: Fizika Astronomiya (Moscow, USSR), v. 26, no. 2, Mar. - Apr. 1985 p 63-66 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The fluorescence dynamics of solutions of organic dyes is investgated using a set-up based on a passive mode-locked YAG laser. The arrangement and calibration of the experimental system are described in detail. The logarithm of the energy of the converted radiation is measured as a function of he delay between the excitation pulses and the pumping pulses. The electron excitation decay time for RB dye was 1.8 plus or minus .2 nsec, and the dipole moment rotation time is 320 plus or minus 3 psec. The method is accurate, and can be used in any spectral band, making it useful in picosecond spectroscopy of condensed media. Author

N86-22290# Joint Publications Research Service, Arlington, Va.
SLOW COMBUSTION OF LASER PLASMA AND OPTICAL CHARGES Thesis - USSR Academy of Sciences, 1984 Abstract Only **c75**
Vadim Borisovich Fedorov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 39-40 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Laser plasma is investigated in the region of moderate lasing intensities, where the electron heating rate in the radiation field is usually slower than the rate At which electrons lose energy, and the electron-ion relaxation rate. Slow laser plasma combustion is detected, in which an optical discharge plasma is maintained at minimum threshold intensity levels for the optical band, with subsonic propagation of the plasma and thermal ionization of the matter a the front of the dicharge in the maintaining radiation field. the process of subsonic propagation of a slow combustion wave of laser plasma is interpreted theoretically. Steady-state unidimensional propagation of a plane wavefront in a collimated laser beam is achieved, and new methods are developed for diagnosing gas motion in the region of subsonic optical discharge. A new method is developed for diagnosing a hot gas (plasma) on a target by measuring the parameters of the plasma near the front of the shockwave. A neodymium glass laser is developed which employs reflecting plasma as a nonlinear mirror in the optical cavity, and also as an optical shutter. Author

N86-22291# Joint Publications Research Service, Arlington, Va.
SPECTROSCOPY OF LABORATORY AND SPACE PLASMA WITH OSCILLATING ELECTRICAL FIELDS Thesis - USSR Academy of Sciences, 1984 Abstract Only **c75**
Evgeniy Aleksandrovich Oks *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 40 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The spontaneous emission spectra of atoms and ions interacting with oscillating electrical fields in a plasma medium are investigated theoretically. The use of these phenomena for plama diagnosis under specific laboratory and space conditions is examined. The I (delta omega) contours of the emitted lines are investigated as a function of the electrical field parameters (the amplitude, the position of the maximum and widths of the frequency spectrum, the degree of elipticity or degree of spatial anisotropy), and of the plasma medium parameters (the electron concentration and temperature, the ion temperature, and the atom temperature). A theory is developed to explain broadening of atom and ion spectral lines in a plasma caused by two types of intra-plasma electrical fields simultaneously: quasimonochromatic and wideband. The simultaneous effect of the latter two types of fields on a coulomb radiator is investigated. A new nonlinear optical effect called dynamic resonance is detected. A nonlinear theory for plasma and laser satellites of spectral lins in homogeneous and inhomogeneous plasma is developed. The plasma diagnostic

methods developed are applied under laboratory conditions. A search program for oscillating electrical fields in space plasma is developed theoretically and carried out. Author

N86-22292# Joint Publications Research Service, Arlington, Va.
EQUILIBRIUM STATES OF CHARGED ELECTRON BEAMS AND SPACE CHARGE COMPENSATION PROCESSES Thesis - USSR Academy of Sciences, 1984 Abstract Only **c75**
Vladimir Alekseyevich Malafayev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 44 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The equilibrium states and stability of a nonrelativistic electron beam in an external longitudinal magnetic field are investigated theoretically and experimentally. Possible equilibrium states of the electron beam with arbitrary cathode shielding is analyzed theoretically, and the theory is tested experimentally for the case of strong magnetic fields. The formation of a virtual cathode in the region in which the beam engers drift space is studied experimentally, as are the processes of compensation and stability of the quasi-steady-state of the beam. Three characteristic equilibrium regions with different geometric dimensions and beam energy characteristics are found. Extremal currents occur for a fixed magnetic field and fixed beam radiants, that increase in values as the magnetic field becomes weaker and the cathode shielding becomes greater. The branch of the state diagram orresponding to high kinetic energy is found to be stable. Instability occurs within the ionization time at low pressures, resulting in azimuthally inhomogeneous beam structure. Author

N86-22293# Joint Publications Research Service, Arlington, Va.
ESTIMATES OF PARAMETERS OF HOT ELECTRONS DURING BEAM HEATING OF PLASMA IN A MAGNETIC FIELD Abstract Only **c75**
B. N. Breyzman and V. I. Yerofeev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 42 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 387-393 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The dynamics of high-energy electrons formed in Langmuir turbulence and excited in a plasma by a relativistic electron beam is examined. The density perturbations that cause waves to move from one region of the phase space to another, and to maintain balance between pumping and attenuation, are assumed to be generated by the high frequency pressure of the Langmuir waves themselves. A kinetic equation is derived for the excitation, attenuation, and elastic scattering of Langmuir waves. The concentration and characteristic energy of the hot electrons is found within the framework of the proposed model. The estimates are compared with the results of experiments conducted on the INAR and GOL-1 installations. Author

N86-22294# Joint Publications Research Service, Arlington, Va.
TWO-DIMENSIONAL KINETIC MODEL OF HYDROGEN MACRO-PARTICLE EVAPORATION IN A TOKAMAK Abstract Only **c75**
B. V. Kuteyev, A. P. Umov, and L. D. Tsendin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 43 Transl. into ENGLISH from Fiziki Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 409-416 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The evaporation of a fuel tablet in a plasma with Maxwell electron distribution by energy and angles is investigated. A formula is derived that approximates to within 10% the relationship between the evaporation rate and temperature, plasma density, and macroparticle radius. Most of the heat reaching the tablet is found to come from electrons at the tail of the distribution function with energies of (6 to 8) T sub e. This accounts for the small influence of electrical fields near the surface on the evaporation rate. Experiments on injecting hydrogen macroparticles into a plasma at the T-10 tokamak are described. Author

N86-22295# Joint Publications Research Service, Arlington, Va.
RELATIVISTIC EFFECTS DURING COMPTON INTERACTION OF STRONG ELECTROMAGNETIC RADIATION AND OPTICALLY THIN LAYER OF COLD PLASMA Abstract Only **c75**
Yu. I. Lysikov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 44 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 497-499 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The development of plasma oscillations when a strong electromagnetic radiation flux interacts with an optically thin layer of cold plasmas is analyzed. A hydrodynamic description of the dynamics of a cold two-component (singly-charged ions and electrons) plasma in a strong electromagnetic radiation field with induced Compton quantum scattering by electrons predominating is used in the analysis. Examples of such systems include objects in space, such as the plasma near pulsars and quasars. A one-dimensional case is examined, assuming an initial uniform electron and ion distribution throughout the entire space. A process of exponential growth of plasma oscillations is found analytically. Author

N86-22296# Joint Publications Research Service, Arlington, Va.
PLASMA FLOWS IN DIVERTOR REGIONS OF VINT-20 SINGLE-PASS TORSATRON Abstract Only **c75**
V. K. Bocharov, Ye. D. Volkov, G. G. Lesnyakov, and V. B. Yuferov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 44 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 500-504 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Plasma flows are investigated along and across the helical divertor magnetic slot in a single-pass Torsatron with a spatial magnetic axis and highly inhomogeneous magnetic field along the line of force. Well-formed plasma jets are shown to occur in the regioin behind the separatrix, indicating the fundamental possibility of achieving a divertor configuration. The width of the divertor flows is no more than one twentieth that of the last closed magnetic surface. The plasma flows along the divertor slot increase in magnitude in the direction of the outer part of the torus. Author

N86-22297# Joint Publications Research Service, Arlington, Va.
COLLISION AND RADIATION PROCESSES IN LOW-TEMPERATURE PLASMA INVOLVING HIGHLY EXCITED ATOMIC AND MOLECULAR STATES Thesis - USSR Academy of Sciences, 1984 Abstract Only **c75**
Vladimir Sergeyeviy Lebedev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 46 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

Elementary collision and radiation processes occurring in gas and plasma involving strongly-excited states of atoms, molecules and molecular ions are investigated theoretically. Simple analytical expressions are derived for the possibilities, cross-sections and velocity constants of these processes. A quasi-classical model is proposed that makes possible analytical calculations of the nuclear matrix elements for the dipole moment of diatomic molecules and ions during transitions between states of continuous and discrete spectra close to the dissociation boundary. Inelastic transitions, as well as direct and associative ionization of highly excited atoms caused by collision between a neutral particle and its atomic trunk are analyzed theoretically. The proposed mechanism underlying inelastic transitions is shown to explain experiments on the extinction of NS atomic levels for alkali metals and inert gases. Author

N86-22298# Joint Publications Research Service, Arlington, Va.
PLASMA MECHANISM UNDERLYING HIGH PRESSURE GAS BREAKDOWN Thesis - USSR Academy of Sciences, 1984 Abstract Only **c75**
Aleksandr Petrovich Broytman *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 47 Transl.

into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The breakdown of gases at high pressure (atmospheric or higher) in strong electrical fields - spark or streamer breakdown - is investigated in order to establish the mechanism underlying the formation of streamer breakdown and o create an adequate theoretical model. Streamer breakdown is divided into three stages: in the first, thermal fluctuations of the homogeneous electron background build up over time and cause distortion of the external magnetic field. In the second stage, the electrical field drops due to longitudinal Debye shielding, resulting in abrupt cooling of the electrons and strong recombination. In the third stage, secondary avalanches, which distort the electrical field as they develop, cause a rapid increase in the plasma region near the electrodes, i.e., streamer propagation. The experimentally observed similarity law alpha d approximately 20 is confirmed by the proposed theory. The quantity alpha d is a logarithmic function of the intensity of the external electrical field and the number of initial electrons causing ionization avalanche. Author

N86-22299# Joint Publications Research Service, Arlington, Va.
NONLINEAR PROPERTIES OF SUPERCONDUCTING POINT CONTACTS AND PROSPECTS FOR USE IN QUANTUM ELECTRONICS Abstract Only **c76**
M. V. Danilenko, V. E. Derkach, E. M. Belenov, V. I. Romanenko, and A. V. Uskov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 48 Transl. into ENGLISH from Kvantovaya Elektronika (Kiev, USSR), v. 27, Oct. 1983 p 3-37 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

The nonlinear properties of superconducting point contacts employed in electrodynamic systems, such as resonators or waveguides, are examined. Two cases are investigated: one in which the currents of the superconducting contact interact only with the fields excited by the contact itself in the resonator or waveguide, and one in which microwave and optical radiation are applied simultaneously or alternately to the contact from without. The study is based on Maxwell's equations for an electromagnetic field in a system incorporating a contact, as well as the material equations describing the contact properties. The multiplicative and mixing properties of superconducting point contacts are investigated. The possibility of developing induced radiation sources and frequency synthesizers operating between the microwave and optical bands based on Josephson junctions is investigated.
Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-22300 Stevens Inst. of Tech., Hoboken, N. J.
STUDIES OF ACOUSTICAL FIELDS GENERATED BY VIBRATING STRUCTURES WITH APPLICATIONS TO NOISE CONTROL BY DESIGN Ph.D. Thesis
Jiann-Kuo Jiang 1985 151 p
Avail: Univ. Microfilms Order No. DA8522788

Machinery noise control problem can generally be classified as noise control at the source, noise control along the path and noise control at the receiver. It is known that noise control at the source usually is the most desirable but difficult approach. The success of the efforts to control noise at the source certainly depends on the knowledge of the influence of various design parameters on the acoustical near and far fields. Vibrating structural components form one of the major sources of noise in machinery. In this thesis theoretical and experimental studies on the acoustical fields due to various types of vibrating structures are conducted. The theoretical work is based on the boundary element method which can effectively deal with the boundary value problems especially associated with an infinite domain. The experimental work was conducted (in an anechoic chamber) to measure the sound pressure levels in the acoustical field generated by various vibrating structures. The types of vibrating structures considered are piston-type and beam-type. Dissert. Abstr.

N86-22301 Stanford Univ., Calif.
HIGH RESOLUTION ACOUSTIC MICROSCOPY Ph.D. Thesis
Babur Baki Hadimioglu 1985 119 p
Avail: Univ. Microfilms Order No. DA8522153

Advancements in the fields of high resolution water and superfluid helium acoustic microscopy are described. The reflection acoustic microscope using water as the coupling fluid was operated at frequencies as high as 5 gigahertz by using ultrashort radio frequency-pulses and acoustic lenses as small as 12 microns in radius. The smallest sound wavelength used for imaging was 3000 Angstroms and the microscope presents a resolution of better than 2000 Angstroms when a nonlinear resolution improvement technique is used. The design and fabrication of the high frequency acoustic transducers are presented. The operating frequency of the acoustic microscope using liquid helium at temperatures less than 0.2 K was increased to 8 gigahertz. The design and fabrication of acoustic transducers to operate at low temperatures are described. The use of the liquid helium microscope at much higher frequencies is also considered. Work is now underway to build a helium microscope at 96 gigahertz with sub-30 Angstroms resolution. Dissert. Abstr.

N86-22302 National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
AN EXPERIMENTAL APPRAISAL OF THE USE OF GROUND-PLANE MICROPHONES FOR AIRCRAFT NOISE MEASUREMENT
R. C. Payne Aug. 1985 50 p refs
(NPL-AC-104; ISSN-0143-7143) Copyright. Avail: Issuing Activity

Sound pressure levels measured using ground-plane microphone configurations are compared with pressure-doubled spectra derived from measurements using a conventional 1.2 m microphone location. Experimental data were obtained under laboratory conditions and in the field using a stationary sound source producing pure tone signals or shaped white noise. An arrangement involving a half-inch condenser microphone inverted over a circular baffle gives a close approximation to a pressure-doubled spectrum. Field trials using over-flights of light propeller-driven aircraft confirm the validity of the arrangement.
Author (ESA)

N86-22303*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COHERENT LARGE-SCALE STRUCTURES IN HIGH REYNOLDS NUMBER SUPERSONIC JETS Final Report
J. Lepicovsky, K. K. Ahuja, W. H. Brown, and R. H. Burrin Washington NASA Dec. 1985 105 p refs
(Contract NAS1-17442)
(NASA-CR-3952; NAS 1.26:3952; LG85ER0111) Avail: NTIS HC A06/MF A01 CSCL 20A

The flow structure of a 50.8 mm (2 in) diameter jet operated at a full expanded Mach number of 1.37, with Reynolds numbers in the range 1.7 to 2.35 million, was examined for the first 20 jet diameters. To facilitate the study of the large scale structure, and determine any coherence, a discrete tone acoustic excitation method was used. Phase locked flow visualization as well as laser velocimeter quantitative measurements were made. The main conclusions derived from this study are: (1) large scale coherent like turbulence structures do exist in large Reynolds number supersonic jets, and they prevail even beyond the potential core; (2) the most preferential Strouhal number for these structures is in the vicinity of 0.4; and (3) quantitatively, the peak amplitudes of these structures are rather low, and are about 1% of the jet exit velocity. Finally, since a number of unique problems related to LV measurements in supersonic jets were encountered, a summary of these problems and lessons learned therefrom are also reported. Author

N86-22304*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRPORT-NOISE LEVELS AND ANNOYANCE MODEL (ALAMO) USER'S GUIDE
Richard DeLoach, James L. Donaldson, and Margaret J. Johnson Jan. 1986 129 p Prepared in cooperation with Computer Sciences Corp., Hampton, Va.
(NASA-TM-87695; NAS 1.15:87695) Avail: NTIS HC A07/MF A01 CSCL 20A

A guide for the use of the Airport-Noise Level and Annoyance MOdel (ALAMO) at the Langley Research Center computer complex is provided. This document is divided into 5 primary sections, the introduction, the purpose of the model, and an in-depth description of the following subsystems: baseline, noise reduction simulation and track analysis. For each subsystem, the user is provided with a description of architecture, an explanation of subsystem use, sample results, and a case runner's check list. It is assumed that the user is familiar with the operations at the Langley Research Center (LaRC) computer complex, the Network Operating System (NOS 1.4) and CYBER Control Language. Incorporated within the ALAMO model is a census database system called SITE II. Author

N86-22305*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRPORT-NOISE LEVELS AND ANNOYANCE MODEL (ALAMO) SYSTEM'S REFERENCE MANUAL
Richard DeLoach, James L. Donaldson, and Margaret J. Johnson Jan. 1986 129 p refs Prepared in cooperation with Computer Sciences Corp., Hampton, Va.
(NASA-TM-87694; NAS 1.15:87694) Avail: NTIS HC A06/MF A01 CSCL 20A

The airport-noise levels and annoyance model (ALAMO) is described in terms of the constituent modules, the execution of ALAMO procedure files, necessary for system execution, and the source code documentation associated with code development at Langley Research Center. The modules constituting ALAMO are presented both in flow graph form, and through a description of the subroutines and functions that comprise them. Author

N86-22306*# Bionetics Corp., Hampton, Va.
AN EVALUATION OF STUDY DESIGN FOR ESTIMATING A TIME-OF-DAY NOISE WEIGHTING
James M. Fields Mar. 1986 30 p refs
(Contract NAS1-16978)
(NASA-CR-178062; NAS 1.26:178062) Avail: NTIS HC A03/MF A01 CSCL 20A

The relative importance of daytime and nighttime noise of the same noise level is represented by a time-of-day weight in noise annoyance models. The high correlations between daytime and nighttime noise were regarded as a major reason that previous social surveys of noise annoyance could not accurately estimate the value of the time-of-day weight. Study designs which would reduce the correlation between daytime and nighttime noise are described. It is concluded that designs based on short term variations in nighttime noise levels would not be able to provide valid measures of response to nighttime noise. The accuracy of the estimate of the time-of-day weight is predicted for designs which are based on long term variations in nighttime noise levels. For these designs it is predicted that it is not possible to form satisfactorily precise estimates of the time-of-day weighting.Author

N86-22307*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTIC RADIATION STRESS MEASUREMENT Patent Application
William T. Yost and John H. Cantrell, Jr., inventors (to NASA) Filed 13 Sep. 1985 10 p
(NASA-Case-LAR-13440-1; NAS 1.71:LAR-13440-1; US-Patent-Appl-SN-775989) Avail: NTIS HC A02/MF A01 CSCL 20A

Ultrasonic radio frequency tone-bursts are launched into a sample of material tested. The amplitude of the tone-bursts and the slope of the resulting static displacement pulses are measured. These measurements are used to calculate the nonlinearities of the materials. NASA

N86-22308*# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
AEROACOUSTICS OF CONTOURED AND SOLID/POROUS CONICAL PLUG-NOZZLE SUPERSONIC JET FLOWS Final Report
Darshan S. Dosanjh and Indu S. Das Dec. 1985 204 p refs
(Grant NAG1-29)
(NASA-CR-176645; NAS 1.26:176645) Avail: NTIS HC A10/MF A01 CSCL 20A

The acoustic far field, the shock-associated noise and characteristics of the repetitive shock structure of supersonic jet flows issuing from a contoured plug-nozzle and uncontoured plug-nozzle having a short conical plug of either a solid or a combination of solid/porous surface with pointed termination operated at a range of supercritical pressure are reported. The contoured and the uncontoured plug-nozzles had the same throat area and the same annular-radius ratio. Author

N86-22309*# Tennessee Univ. Space Inst., Tullahoma. Space Inst.
NONLINEAR ACOUSTIC WAVE PROPAGATION IN ATMOSPHERE Final Report, 1 Oct. 1984 - 31 Oct. 1985
S. I. Hariharan Oct. 1985 28 p refs
(Grant NAG1-527)
(NASA-CR-176642; NAS 1.26:176642) Avail: NTIS HC A03/MF A01 CSCL 20A

A model problem that simulates an atmospheric acoustic wave propagation situation that is nonlinear is considered. The model is derived from the basic Euler equations for the atmospheric flow and from the regular perturbations for the acoustic part. The nonlinear effects are studied by obtaining two successive linear problems in which the second one involves the solution of the first problem. Well posedness of these problems is discussed and approximations of the radiation boundary conditions that can be used in numerical simulations are presented. Author

N86-22310# Washington State Univ., Pullman. Dept. of Physics.
RESEARCH ON ACOUSTICAL SCATTERING, OPTICS OF BUBBLES, DIFFRACTION CATASTROPHES, AND LASER GENERATION OF SOUND BY BUBBLES Annual Summary Report, 1 Oct. 1984 - 30 Sep. 1985
Philip L. Marston Sep. 1985 72 p
(Contract N00014-85-C-0141)
(AD-A161333; ASR-5) Avail: NTIS HC A04/MF A01 CSCL 20/1

The research summarized concerns four topics of the propagation and scattering of acoustical and optical waves: (1) acoustical scattering theory and experiments (focused backscattering from elastic spheres due to Rayleigh waves and resonances, Sommerfeld-Watson transformation or predicting echo amplitudes and resonance phenomena, scattering from complicated elastic objects); (2) novel manifestations of diffraction catastrophes and their application to inverse problems (optical hyperbolic-umbilic and cusp diffraction catastrophes in the scattering from a penetrable spheroid, angular location of the cusp as a method of inverse scattering, calculation of the shape of the wavefront which produces a directional cusp diffraction catastrophe); (3) production of sound by a bubble in water illuminated by modulated light (bubbles as a novel photoacoustic source, photoacoustics as a method of investigating adsorbed films or bubbles in water); (4) light scattering from real bubbles in water (optical backscattering from freely rising bubbles in water, the unfolded glory of an oblate bubble, optical effects of adsorbed films.) GRA

N86-22311# Naval Submarine Medical Research Lab., Groton, Conn.
TEMPORARY AUDITORY-THRESHOLD SHIFTS INDUCED BY TWENTY-FIVE-MINUTE CONTINUOUS EXPOSURES TO IN-

TENSE TONES IN WATER Interim Report
Paul F. Smith and John J. Wojtowicz 25 Sep. 1985 19 p
(M00-96-PN)
(AD-A162404; NSMRL-1063) Avail: NTIS HC A02/MF A01 CSCL 20/1

Four bare-headed divers were exposed for twenty-five minutes to continuous tones in water at frequencies of 700, 1400, and 5600 hertz at estimated sound pressure levels between 153 and 165 decibels (dB) above 20 micropascal. Subsequent analyses revealed that the eight ears involved were actually exposed to average sound pressure levels between 143.1 and 165.1 dB. These exposure levels are comparable to those to which divers may be exposed while using some underwater hand-held tools. Temporary auditory-threshold shifts (TTS) were measured from two minutes to five minutes after the exposure terminated. TTS at two minutes post-exposure was between 23 and 55 dB and recovery times varied from twenty-four hours to more than fifty hours depending on exposure conditions. Nonauditory effects including middle-ear sensations and a reddened ear-drum were also observed. The results indicate that several hand-held tools now in use by military and civilian divers are extremely hazardous to hearing. The results also support the theory that the dynamic range of the water-immersed ear is smaller than the dynamic range of the ear in air. GRA

N86-22312# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
MEASUREMENT OF NOISE FROM AIRPLANES TRAVELING AT HEIGHTS 3500 TO 6000m
Magnus Linde and Staffan Meijer Sep. 1985 19 p ref
(Contract STU-AU-2168)
(FFA-TI-AU-2168) Avail: NTIS HC A02/MF A01

The noise on the ground produced by overflights of jet and propeller airplanes, at different flight levels, was studied to provide a basis for the estimation of the noise from future propeller airplanes. The noise on the ground from airplanes at heights 3500 to 6000m was measured. Author (ESA)

N86-22255# Joint Publications Research Service, Arlington, Va.
BRANCHES OF ACOUSTIC OSCILLATIONS OF A GAS INTERACTING IN RESONANCE WITH LIGHT Abstract Only
F. Kh. Gelmukhanov and L. V. Ilichev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 1 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Theoreticheskoy Fiziki (Moscow, USSR), v. 88, no. 3, Mar. 1985 p 733-740 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-22313 Stanford Univ., Calif.
EXTREME ULTRAVIOLET EMISSION SPECTROSCOPY OF ATOMS AND LASER APPLICATIONS Ph.D. Thesis
Andrew James Mendelsohn 1985 137 p
Avail: Univ. Microfilms Order No. DA8522199

Many extreme ultraviolet (XUV) laser schemes are limited by the short autoionizing lifetimes of atomic states which lie above the ionization threshold. Two approaches to dealing with this problem are presented. The properties of a class of levels known as quasi-metastable levels are investigated. These levels are relatively metastable against autoionization due to a number of selection rules and possess substantial branching ratios for radiation in the XUV. Autoionizing and radiative rates are calculated for quasi-metastable levels in alkali atoms with a Hartree-Fock code. The results of emission spectra confirming the high radiative yield of these states is presented. Implications for several proposed XUV laser schemes are discussed. The use of MMM super Coster-Kronig transitions in Zn to produce inversion and gain on several transitions in Zn3 between 56.8 nm and 133.8 nm are examined. The super Coster-Kronig transition converts 90% of Zn2 ions created by photoionization in a laser-produced plasma into Zn3 3d84s2 ions at an energy of approximately 65 eV. Several laser schemes utilizing this selective autoionization process are discussed. Experimental verification of the high super Coster-Kronig branching ratio in a microwave discharge cell is presented. Dissert. Abstr.

N86-22314# National Aerospace Lab., Tokyo (Japan). First Aerodynamics Div.
SENSITIVITY OF ELECTRON THERMALIZATION IN RARE GASES TO MOMENTUM-TRANSFER CROSS SECTION AND IMPURITIES
Katsuhisa Koura Jul. 1985 11 p refs
(NAL-TR-866T; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

The sensitivity of the electron thermalization in rare gases to the momentum-transfer cross section sigma sub m (epsilon) and gas impurities is investigated using both the Monte Carlo simulation and the empirical equation for the electron energy-loss rate in relation to the remarkable discrepancy betweem the theoretical and experimental results revealed in rare gases with the Ramsauer minimum. The electron thermalization is very sensitive to sigma sub m (epsilon), because the more accurate data of sigma sub m (epsilon) with the smaller Ramsauer minimum enlarge the discrepancy. The electron thermalization is shown to be so sensitive to gas impurities that it is considered probable that molecular impurities cause the discrepancy even for an experiment with a purity grade better than 99.9%. Author

N86-22315 Duke Univ., Durham, N. C.
A STUDY OF ORIENTATIONAL ORDERING IN SOLID DEUTERIUM Ph.D. Thesis
Myron Eugene Calkins, Jr. 1985 363 p
Avail: Univ. Microfilms Order No. DA8523033

Nuclear magnetic resonance (NMR) studies were performed on samples of solid deuterium with para concentrations X in the range $0.05 < X < 0.07$ at temperatures between 0.032 and 3.0 K and at a Larmor frequency of 5.88 MHz. This range of temperatures and concentrations includes the first order transition to the long range orientational ordered state. The spin-lattice relaxation times for both ortho ($1 = 2$) and para ($1 = 1$)D2 species were measured by the intensity of solid echoes generated by the pulse sequence. In addition, the solid echoes themselves were digitized which, through the use of the fast Fourier transform, provided both the lineshapes of the two species, and the second-moments M sub 2 of their absorption lines. At all concentrations below which the transition to a long range ordered phase does not occur, the temperature dependence of the lineshape, secondmoment, and spin-lattice relaxation times is quite smooth. Dissert. Abstr.

N86-22316 Boston Coll., Chestnut Hill, Mass.
ELECTRONIC ENERGY TRANSFER AMONG COMPLEX MOLECULES Ph.D. Thesis
Oktay Demir 1985 242 p
Avail: Univ. Microfilms Order No. DA8522279

Electronic energy transfer among complex molecules in gas phase and in polar solvents was studied by employing naphthalene and biacetyl as sensitizer and activator, respectively. Triplet-triplet energy transfer from naphthalene to biacetyl was observed. In the gas phase at 310 nm, in polar solvents 230 nm, 295 nm and 325 nm excitation bands were found as the starting points in the mechanism of energy transfer for the 560 nm sensitized phosphorescence emission from biacetyl. An experimental method to determine the interaction mechanism between sensitizer-activator pairs of complex molecules was developed; the molecular interaction mechanism taking place in the energy transfer was found to be of exchange type. A transient physical molecule model (PMOL) was introduced to explain the proposed energy gap law. Based on the experimental observations and conclusions a triplet-triplet energy transfer model including the FEET phenomenon was constructed. Dissert. Abstr.

N86-22317# York Univ., Toronto (Ontario). Dept. of Chemistry.
CORRELATIONS BETWEEN ELECTROCHEMICAL POTENTIALS AND OPTICAL CHARGE TRANSFER ENERGIES IN RUTHENIUM BIPYRIDINE DERIVATIVES
Elaine S. Dodsworth and A. B. P. Lever Apr. 1985 22 p
(Contract N00014-84-G-0201)
(AD-A161668; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/4

Linear relationships are discussed linking the Ru yields Pl*(byp) charge transfer transition energy in the species (Ru(bipyridine)2XY) (n+)(X,Y various non-diimine ligands, n=0,1,2) and the observed potentials E (Ru(III)/Ru(II)), E((bpy)/(bpy(-)) and their difference. The conditions under which such relationships might be valid are investigated. Correlation of E(Ru(III)/Ru(II)) is also explored. The results permit the use of optical energies to calculate CT energies and vice versa. GRA

N86-22318# Physical Sciences, Inc., Andover, Mass.
FLUORESCENCE FROM ELECTRON IRRADIATED GASES IN REFURBISHED LABCEDE Final Report, 25 Sep. 1980 - 29 Feb. 1984
B. D. Green, L. G. Piper, G. E. Caledonia, P. F. Lewis, and H. C. Murphy Sep. 1985 366 p
(Contract F19628-80-C-0168)
(AD-A161674; PSI-TR-433; AFGL-TR-84-0218) Avail: NTIS HC A16/MF A01 CSCL 04/1

This report describes our efforts directed toward the study of electron-irradiated gases of atmospheric interest as part of the LABCEDE project. Emission spectra of nitrogen and air between 185 and 900 nm were surveyed and compared to observations of auroral radiances. Infrared spectral surveys using a CVF and interferometer provided many intriguing observations which suggest numerous future measurements programs. A series of measurements undertaken on the higher-pressure apparatus identified N(2D) as responsible for NH formation in N2/H2 mixtures by altering the neutral and ionic kinetics with trace species. The absolute production rates of vibrationally excited NO in irradiated N2/O2 mixtures are determined, with N(2D) felt to be the reaction precursor. About two precent of the total energy deposited in the gas by the electron beam appears as NO vibrational energy, A discussion of self-trapping of CO2(nu5) emission is given to illustrate the modification of the observed fluorescence spectrum due to hot band and istopic emissions. The excitation and quenching of Meinel bands by air and nitrogen are also reported. Large intensity enhancements have been observed in the presence of applied magnetic fields. Preliminary observations and explanations of this beam plasma discharge phenomenon are given. GRA

N86-22319# Washington Univ., Seattle. Dept. of Chemistry.
AVERAGE COLLISIONAL VIBRATIONAL ENERGY TRANSFER QUANTITIES. THE EXPONENTIAL MODEL
B. S. Rabinovitch 15 Nov. 1985 33 p
(Contract N00014-75-C-0690)
(AD-A161814; NR092-549-TR32) Avail: NTIS HC A03/MF A01 CSCL 20/8

The important collisional energy transfer ratio, gamma = <delta E>sub all/<delta E> sub d was examined by using a fitted classical approximation for the density of internal energy eigenstates. The exponential form of the collisional energy transfer probability function was applied to four model unimolecular reaction systems. Two parameters, the inversion temperature TI and the effective temperature Te (defined previously in I), were employed to develop a form for the parametric dependence of gamma on <delta E> sub d, energy level E and temperature T; these quantities are related to a reduced average energy transfer quantity E' sub e. Comparison was made with previous literature expressions for the inter-relationship between <delta E>sub all and <delta E>sub d for both exponential and stepladder models of the collisional transition probabilities. GRA

N86-22320# Arizona Univ., Tucson. Dept. of Chemistry.
COMPLEX MIXTURE ANALYSIS BY PHOTOIONIZATION MASS SPECTROMETRY WITH A VUV HYDROGEN LASER SOURCE Interim Technical Report
Thomas C. Huth and M. B. Denton 6 Dec. 1985 22 p
(Contract N00014-83-K-0268)
(AD-A162401; TR-44) Avail: NTIS HC A02/MF A01 CSCL 07/5

Trace organic analysis in complex matrix presents one of the most challenging problems in analytical mass spectrometry. When ionization is accomplished non-selectively using electron impact, extensive sample clean-up is often necessary in order to isolate the analyte from the matrix. Sample preparation can be greatly reduced when the VUV H2 laser is used to selectively photoionize only a small fraction of compounds introduced into the ion source. This device produces parent ions only for all compounds whose ionization potentials lie below a threshold value determined by the photon energy of 7.8 eV. The only observed interference arises from electron impact ionization, when scattered laser radiation interacts with metal surfaces, producing electrons which are then accelerated by potential fields inside the source. These can be suppressed to levels acceptable for practical analysis through proper instrumental design. Results are presented which indicate the ability of this ion source to discriminate against interfering matrix components, in simple extracts from a variety of complex real world matrices, such as brewed coffee, beer, and urine. GRA

N86-22321# Purdue Univ., West Lafayette, Ind. Dept. of Physics.
INELASTIC SCATTERING IN CONDENSED MATTER WITH HIGH INTENSITY MOESSBAUER RADIATION Progress Report, 1 Mar. - 31 Oct. 1985
J. G. Mullen Oct. 1985 9 p
(Contract DE-FG02-85ER-45199)
(DE86-002461; DOE/ER-45199/1) Avail: NTIS HC A02/MF A01

The past year has seen the completion of most of the design and construction phases of instrument development and the beginning of scientific investigations. Many technical difficulties relating to mechanical strains in the source cryostat and in the Microfoil Internal Conversion Electron (MICE) detector assembly caused by cycling them between 300 and 100 K have been overcome. The scientific work has been highlighted by the performance of the MICE detector and how it has allowed measurement of the asymmetry parameters in w-183 and w-182 much more reliably than in the past, and by the high momentum resolution made possible with intense sources as demonstrated by studies on Si. DOE

N86-22322# California Univ., Berkeley. Lawrence Berkeley Lab.
THEORETICAL STUDY OF INTERMOLECULAR ENERGY TRANSFER OF AN ELECTRONICALLY EXCITED DIATOMIC MOLECULE BY ATOM IMPACT: He((1)S) + H2(B (1)(SIGMA)(+) /SUB u/)
R. M. Grimes, W. A. Lester, Jr., and M. Dupuis May 1985 18 p refs Presented at the 12th Annual Meeting of the National Organization of Black Chemists and Chemical Engineers, Minneapolis, Minn., 22 May 1985
(Contract DE-AC03-76SF-00098)
(DE86-001480; LBL-19331; CONF-8505193-2) Avail: NTIS HC A02/MF A01

An ab initio potential energy surface (pes) for He + H2(B (1)(SIGMA)+ sub u) has been determined using self-consistent field plus configuration interaction methods. The long-term interactions are described by a multipole expansion. The He-H2(B (1)(SIGMA)(+) sub u) interaction energy is much more anisotropic than those of ground state systems studied to date. As a first step in the dynamics studies, cross sections for rotational excitation at c.m. energies 0.015 to 0.105 eV have been computed in the rigid-rotator model using the space-fixed coupled-channel formalism and an analytical fit to the ab initio pes. Partial inelastic cross sections display a high degree of structure, which appears to be mainly due to the anisotropy of the interaction energy. The magnitudes of total cross sections for (DELTA)j = + - 2 transitions are comparable to those for ion-molecule systems. DOE

N86-22323# George Washington Univ., Washington, D.C. Office of Sponsored Research.

INVESTIGATIONS OF THE STRUCTURE AND ELECTROMAGNETIC INTERACTION OF FEW-BODY SYSTEMS
D. R. Lehman 1985 35 p
(Contract DE-AS05-79ER-10332)
(DE86-001659; DOE/ER-10332/15) Avail: NTIS HC A02/MF A01

Progress is reported in these areas: (GAMMA)(3)He (YIELDS) pd in the 200 < E sub gamma < 400 MeV region; application of the Austern model to the reactions (GAMMA)He-3 (YIELDS) pd, (PI) sup 0 He-3 (YIELDS) pd; analyzing power in pd (YIELDS) (GAMMA)He-3 at intermediate energies; elastic and inelastic electron scattering from Li-6; quasielastic electron and proton scattering from Li-3; higher shell orbitals in Li-6 in jj and LS coupling and the magnetic moment of Li-6 from three-body models. Other areas of study include: explanation of the binding energy difference between the ground and first excited state of the A = 4 (LAMBDA)-hypernuclei; the asymptotic normalization constants for He-4 (YIELDS)n+He-3 and He-4(YIELDS)d + d; low-energy two body photodisintegration of He-3 and H-3; photodisintegration of the deuteron; and photodisintegration of the trinculeon at intermediate energies. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-22324 Northwestern Univ., Evanston, Ill.
MEASUREMENTS OF PROTON-PROTON AND PROTON-ANTIPROTON ELASTIC SCATTERING AT THE EUROPEAN CENTER FOR NUCLEAR RESEARCH INTERSECTING STORAGE RINGS Ph.D. Thesis
Norman Alexander Amos 1985 204 p
Avail: Univ. Microfilms Order No. DA8523495

Proton-proton and proton-anitproton elastic scattering were measured at the CERN Intersecting Storage rings. Using the optical theorem, the total nuclear cross sections was extracted for these collisions. By measuring the interference between the Coulomb amplitude and the nuclear amplitude rho, the ratio of the real part to the imaginary part of the forward nuclear elastic scattering amplitude was found. Further, the nuclear slope parameter was extracted in the forward direction. The elastic scattering measurements were made at small scattering angles (approx. 1 milliradian), demanding that the detectors be placed close to the beams. Normalization of the data was performed by two methods: Van der Meer calibrations were performed on sets of luminosity monitor counters, the known Coulomb differential scattering cross section fixed the normalization scale. Dissert. Abstr.

N86-22325 Duke Univ., Durham, N. C.
RADIATIVE NEUTRON CAPTURE BY DEUTERUM Ph.D. Thesis
George Mitev 1984 178 p
Avail: Univ. Microfilms Order No. DA8520829

A study of the H-2(n,g)H-3 reaction was performed employing polarized and unpolarized beams of neutrons. Angular distributions of cross sections were measured at E sub n = 9.0, 10.8 and 14.0 MeV. An expansion in Legendre polynomials was fit to the data and the resulting coefficients are reported. Polarized neutrons were employed to measure an angular distribution of analyzing powers E sub n = 9.0 MeV. Coefficients resulting from fitting an expansion in associated Legendre polynomials to the angular distribution are reported. The combined analyzing power and cross section data at this energy were analyzed under simplifying assumptions to determine significant transition matrix elements of the H-2(n, gamma)H-3 reaction. Total cross sections have been determined at E sub n =9.0, 10.8 and 14.0 MeV from fits to the angular distributions. A three-body direct capture calculation was performed in an effort to reconcile theory with experiment, but the results are essentially the same as those of the two-body calculations. Dissert. Abstr.

N86-22326# Brookhaven National Lab., Upton, N. Y.
[ACTIVITY OF THE NATIONAL SYNCHROTRON LIGHT SOURCE (NSLS)] Annual Report
R. Klaffky, ed. and W. Thomlinson, ed. 1984 204 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51840) Avail: NTIS HC A10/MF A01

The National Synchrotron Light Source (NSLS), located at Brookhaven National Laboratory, is a national user facility supported by the U.S. Department of Energy. The NSLS has two electron storage rings dedicated to the production of UV and X-ray radiation. The 750 MeV VUV facility has been in operation since 1982. The frst NSLS comprehensive Annual Report contains reports on work carried out on its VUV storage ring during Fiscal 1984. For individual titles, see N86-22327 through N86-22373.

N86-22327# Bell Telephone Labs., Inc., Murray Hill, N. J.
METAL-INSULATOR TRANSITION ON THE Ge(001) SURFACE
S. Kevan and N. G. Stoffel *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 73-75 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The (001) surfaces of germanium and silicon are prototypical examples of systems possessing a strong, short range reconstruction accompanied by a longer ranger weaker ordering. The short range interaction is generally accepted to involve asymmetric dimerization of nearest neighboring surface atoms. The energetics involved are hence those of chemical bond formation. If this were the only ordering present, a (2x1) surface unit cell would result. Various reports of larger unit cells (p(2x2), c(2x2), c(4x2)) have usually been explained in terms of longer range, energetically weaker ordering of neighboring dimers. Recently, total-energy surface slab calculations have been combined with renormalization group techniques to predict a phase transition at approx 200K on both surfaces from a low temperature phase in which the dimers are ordered to a high temperature phase in which the dimer bond is preserved but the dimers are randomly oriented. Such a transition was subsequently observed by LEED. High resolution angle-resolved photoemission (ARP) experiments are reported which indicate that this transition is accompanied by a metal insulator transition. F.M.R.

N86-22328# Bell Telephone Labs., Inc., Murray Hill, N. J.
SURFACE STATES ON SIMPLE METAL SURFACES
S. D. Kevan, N. G. Stoffel, and N. V. Smith *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 76-78 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The existence of electronic states localized at nominally clean metal surfaces has long been a subject of interest. The accurate characterization of such states continues to be an active area of experimental and theoretical work. In the past year, using high-resolution synchrotron radiation based angle-resolved photoemission (ARP), the number of known surface states on a fw simple metal surfaces has been nearly doubled. In addition, very accurate 2-dimensional energy dispersion relations have been measured and compared to the latest self-consistent calculations. A summary of these results is given. Author

N86-22329# Bell Telephone Labs., Inc., Murray Hill, N. J.
ANGLE RESOLVED PHOTOEMISSION STUDIES OF ELECTRONIC STRUCTURE
N. G. Stoffel, S. D. Kevan, and N. V. Smith *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 79-81 (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Angle resolved photoelectron spectroscopy (ARPES) is an effective technique for determining the valence electronic structure of ordered two- and three-dimensional systems. Summaries of two ARPES studies performed at the U4 beamline of the NSLS UUV ring are presented. This beamline is comprised of a 6-meter toroidal

grating monochromator and a high-resolution hemispherical photoelectron-energy analyzer in an ultrahigh vacuum chamber.
Author

N86-22330# Brookhaven National Lab., Upton, N. Y.
BEAM LINE U5: (FEL AND DIAGNOSTIC LINE)
Alfredo Luccio *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 82-84 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Beam line #5 in the VUV storage ring includes two beam lines: the Free Electron Laser (FEL) line and a beam diagnostic line. The FEL line extends from one of the straight sections of the VUV ring, where the permanent magnet undulator is installed. At the present time, there are three stations on this line: (1) upstream and (2) downstream of the ring straight for the FEL experiment, and (3) midway downstream to use the undulator as a source of monochromatic radiation in the far ultraviolet. The FEL beam line was designed to carry on an experiment of production of coherent radiation in the visible-to-ultraviolet region of the spectrum. An amplifier and a laser oscillator are being studied. For the amplifier, a CW Argon-Ion laser is being used together with a variable gap, 38 period permanent magnetic undulator. The laser is located in the FEL downstream station hutch; its beam propagates counter the direction of motion of the electrons in the VUV straight, along a line two meters above the electron orbit plane. In the upstream station hutch the laser beam is deflected downwards and then steered into the storage ring. There, the laser beam is propagated collinear with the electron beam. The undulator installed on the ring early in 1983 and systematic tests were performed during the summer of 1984.
Author

N86-22331# Brookhaven National Lab., Upton, N. Y.
UNDULATOR BASED BEAMLINE STUDIES ON U5
L. McDonnell, P.D. Johnson, R. W. Klaffky, and N. V. Smith (Bell Labs., Murray Hill, N.J.) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 85-87 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

An undulator installed on beamline U5 at NSLS is expected to produce an intense flux of photons into a highly collimated beam. At normal operating energies (750 MeV) the FEL undulator is expected to have a fundamental harmonic at wavelength lambda = 300A for magnetic strength parameter K = 1. A simple beamline has been constructed to allow measurements of the absolute photon flux available from this device at wavelengths in the long wavelength tail of the fundamental. The central element of this beamline is a small monochromator based on the chromatic aberration properties of a LiF lens. This lens focuses different wavelengths at different points along the optical axis and monochromatization is achieved by moving the lens to focus different wavelengths onto a fixed 200 microns wide exit slit. Photoelectron spectroscopy was carried out with a CMA; photoelectrons being ejected from a freshly evaporated gold surface. Examination of a typical series of EDC's recorded on this system allows measurements of the bandwidth of the monochromator to be made. By measuring the total yield of electrons from the surface and comparing with previously published electron yield measurements from the same surface it is possible to obtain the total flux of photons from the undultor source. F.M.R.

N86-22332# IBM Watson Research Center, Yorktown Heights, N.Y.
X-RAY LITHOGRAPHY: BEAMLINE U6
Jerome P. Silverman, Rolf P. Haelbich, and John M. Warlaumont *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 88-90 refs (For primary document see N86-22326 12-73)
(Contract N00014-82-C-2094)
Avail: NTIS HC A10/MF A01

Over the last decade there have been remarkable advances in the manufacture of integrated circuits. In 1974, the smallest features being replicated in production were about 4.0 microns wide; by now (1984) they have shrunk to 1.0 microns wide. At this size, however, it has become increasingly difficult to progress to smaller features because of the blurring caused by diffraction of the UV light used to expose the photoresist on the silicon wafers. Although there are techniques being developed to extend conventional optical lithography to smaller dimensions, they are difficult and costly. An alternative approach is to use X-rays, which, because of their much shorter wavelength, promise better resolution than can be obtained by todays's methods. The primary goal of this effort is to develop a system to use synchrotron radiation for X-ray lithography. Synchrotron radiation has two major advantages over conventional X-ray sources: the radiation is collimated, and it is orders of magnitude more intense. It is believed that a storage ring source will allow the best possible resolution with reasonable throughput.
Author

N86-22333# Exxon Research and Engineering Co., Annandale, N.J. Corporate Research Science Labs.
FRAGMENTATION OF SMALL MOLECULES FOLLOWING SOFT X-RAY ABSORPTION NEAR THE CARBON K-EDGE
W. Eberhardt, T. K. Sham (Brookhaven National Lab., Upton, N.Y.), R. G. Carr (Brookhaven National Lab., Upton, N.Y.), S. Krummacher (State Univ. of New York, Stony Brook), M. Strongin (Brookhaven National Lab., Upton, N.Y.), S. L. Weng (Brookhaven National Lab., Upton, N.Y.), and D. Wesner (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 91-93 refs (For primary document see N86-22326 12-73)
(Contracts DE-AC02-76CH-00016; DE-AC02-80ER-10750)
Avail: NTIS HC A10/MF A01

The absorption of soft X-ray photons by Cls electrons in CO, as well as in a number of aliphatic and aromatic hydrocarbons and their derivatives, has been studied by carbon K-edge absorption spectroscopy at the NSLS U7 beamline in the ion yield mode. It is found that the absorption process results in ionic fragmentation of the original molecules. The fragmentation pattern changes whether the Cls electron gets ionized or excited into a Rydberg-like orbital, or into an unfilled molecular orbital, or into a quasibound resonance state. Moreover, the fragmentation occurs specifically around the site of the carbon atom where the bound (atomic) to bound (molecular orbital) transition takes place. Based on these observations one might consider the use of tunable X-ray to produce the heretofore uninvestigated excited states and to induce photochemistry or to selectively break large organic molecules. The latter has very interesting implications in photo-stimulated desorption from surfaces, biology, and lithography.
Author

N86-22334# Exxon Research and Engineering Co., Annandale, N.J.
CORE LEVEL SHIFTS AND ELECTRONIC STRUCTURE OF Cu3Au
W. Eberhardt, Sicheng Wu (State Univ. of New York, Stony Brook), R. F. Garrett (State Univ. of New York, Stony Brook), D. Sondericker (State Univ. of New York, Stony Brook), and F. P. Jona (State Univ. of New York, Stony Brook) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 94-96 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-80ER-10750)
Avail: NTIS HC A10/MF A01

The effects of geometry and charge transfer between the constituents of an alloy on its electronic structure are studied. Alloys, together with small metal particles, are known to be very good catalysts for a number of chemical reactions, but very little is known about the atomic and electronic structures of their surfaces. This photoemission study of the /100/ and /111/ surfaces of Cu3Au was undertaken in conjunction with LEED (low energy electron diffraction) and AES (Auger electron spectroscopy) structural studies of Cu3Au and Ni3Al which are being performed at Stony Brook. This work has established that the /100/ surfaces of these A3B-type ordered alloys consists of 50% A and 50% B,

with the second layer being 100% A, while the /111/ surfaces always have 75% A and 25% B. Author

N86-22335# Exxon Research and Engineering Co., Annandale, N.J.
ANGLE RESOLVED PHOTOEMISSION AND BAND STRUCTURE OF Cu3Au
W. Eberhardt, Sicheng Wu (State Univ. of New York, Stony Brook), J. Sokolov (State Univ. of New York, Stony Brook), D. Sondericker (State Univ. of New York, Stony Brook), R. F. Garrett (State Univ. of New York, Stony Brook), and F. P. Jona (State Univ. of New York, Stony Brook) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 97-98 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-80ER-10750)
Avail: NTIS HC A10/MF A01

For the purpose of determining the band structure, its difference from the band structure of the constituents, and the extent of the agreement with band-structure calculations, a study of normal photoelectric emission from Cu3Au/001/ and Cu3Au/111/ as a function of photon energy was undertaken. The following reports the preliminary results of this investigation. Author

N86-22336# Brookhaven National Lab., Upton, N. Y.
PHOTON ENERGY DEPENDENT BRANCHING RATIOS OF THE INNER VALENCE SATELLITES IN THE PHOTOEMISSION OF SOLID ETHYLENE
V. Murgai, S. L. Hulbert, P. D. Johnson, Myron Strongin, and W. Eberhardt (Exxon Research and Engineering Co., Annandale, N.J.) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 99-100 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

Measurements of the photoelectron branching ratios of the outer and inner valance emission of solid ethylene (C2H4) as a function of photon energy between 40 eV and 200 eV have resulted in the identification of the various photoemission lines. Whereas the single particle picture is valid for photoemission from the outer valance orbitals, the excitation of the innermost valance orbital of ethylene (C 2s derived, 2ag symmetry) is accompanied by a shake-up satellite. Ethylene, along with acetylene, is the simplest hydrocarbon that exhibits significant shake-up structure. The experiments were performed on NSLS bealine U7A using a plane grating monochromator. Author

N86-22337# Brookhaven National Lab., Upton, N. Y.
STUDIES OF Gd CLUSTERS ON CARBON: THE QUESTION OF INITIAL STATE OR FINAL STATE EFFECTS
V. Murgai, S. Raaen, Myron Strongin, and Paul Citrin (Bell Labs., Murray Hill, N.J.) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 101-103 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

The question of whether the core levels of metal clusters are shifted due to initial state effects, or whether instead the final state configuration of the cluster is the major source of the core level shift, still remains unsettled. Part of this problem involves the intrinsic difficulty of devising an experiment which unambiguously distinguishes between final state effects and initial state effects. As an example of an initial state effect the levels of very small clusters of Pd in tunneling contact with a metal, Nb, substrated, but not actually touching is considered. The cluster states are referenced to the substrate vacuum level, and since the affinity level in the small cluster can be above the Fermi level of the metal substrate, charge cannot flow from the substrate to the particle to equilibriate Fermi levels. In this case the system is not in equilibrium and the vacuum level serves as the reference level. It is only when the particle size increases enough so that charge can be transferred that thermodynamic equilibrium is attained and the Fermi level becomes the reference level. Experiments on this system are consistent with this interpretation. Author

N86-22338# Brookhaven National Lab., Upton, N. Y.
CORE LEVEL SHIFT OF Pt CLUSTERS IN SI02: THE TRANSITION FROM METALLIC TO INSULATING BEHAVIOR
V. Murgai, S. Raaen, Myron Strongin, R. Garrett (State Univ. of New York, Stony Brook), and P. Citrin (Bell Labs., Murray Hill, N.J.) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 104-106 refs (For primary document see N86-22326 12-73)
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The core level shifts and valance band features of Pt in an SiO2 matrix were determined as a function of Pt concentration. At a Pt fraction of about 0.6 the Pt resistance changes by two orders of magnitude. This is presumably a percolation transition where continuous Pt paths do not exist below this concentration. The experiments described investigate changes in the valance band and core levels as one goes from metallic to insulating behavior. Author

N86-22339# Brookhaven National Lab., Upton, N. Y. Physics Dept.
PHOTON DESORPTION STUDIES OF SYNCHROTRON MATERIALS
Xiaohe Pan, R. Corderman, F. E. Loeb, and Myron Strongin *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 107-109 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Preliminary photodesorption studies have been made on an aluminum alloy used as the chamber material at NSLS. The studies were made for different cleaning procedures and after different sputtering procedures. One of the cleaning processes employed common solvents such as acetone and then alcohol, and the other treatment employed a more complex recipe which included a NaOH etch. Before this second treatment the samples were also polished. The desorption experiments were done by inserting the samples into the U7 beamline before the plane grating monochromator. Hence the samples were in the direct white beam. Auger spectra are shown for a solvent cleaned Al sample which is Ar sputtered for various times. Other spectra for hydrogen sputtering and oxygen sputtering show similar removal of carbon. Author

N86-22340# Brookhaven National Lab., Upton, N. Y.
THE ADSORPTION OF CARBON MONOXIDE ON PALLADIUM FILMS
M. W. Ruckman, P. D. Johnson, and Myron Strongin *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 110-111 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

Studies of the growth of palladium overlayers on a Ta(110) substrate show that in the region of one monolayer coverage there is a reduction in the density of states at the Fermi level, a characteristic of the noble metals. Representative photoemission spectra from these different coverages are shown. Carbon monoxide is found to adsorb molecularly on the thicker palladium films which grow parallel to the (111) direction, in agreement with earlier studies of adsorption on Pd(111) crystals. However at room temperature no adsorption is found to occur on a palladium monolayer. Studies of carbon monoxide adsorption of these palladium monolayers cooled to liquid nitrogen temperatures have been done. It is found that at the lower temperatures, carbon monoxide is adsorbed and that the photoemission spectra have a similar structure to those recorded from carbon monoxide adsorption on the noble metals. The photoemission spectra observed for carbon monoxide adsorbed at liquid nitrogen temperatures on the palladium monolayers and on the thicker palladium films are compared. Both spectra show features that may be interpreted in terms of electron excitation from molecular orbitals associated with the CO. F.M.R.

N86-22341# Brookhaven National Lab., Upton, N. Y.
NI, Pd AND Pt OVERLAYERS ON Ta(110)

M. W. Ruckman, V. Murgai, and Myron Strongin *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 112-114 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

Initial work on Pd overlayers grown on Nb showed that the single monolayer had chemical properties that are different from either the bulk overlayer metal itself, or the substrate. These changed properties included reduced hydrogen dissociation and reduced CO adsorption. The dynamic changes were correlated with drastic changes in the density of states near E sub F. The work presented here extends this work to layers of Ni and Pt, and besides the photon energy dependence of the valance band structure, fairly extensive studies were made of core level spectra. There were two significant features of the core level results. In the case of Pd on Ta it was demonstrated that Pd layers prepared by deposition, and by heating a thicker layer to leave a stable monolayer structure, were actually somewhat different. This is with comparable LEED spectra and valance band spectra. In the case of Pt where there are sharp 4f levels it was possible to analyze both the substrate (Ta 4f) core level shifts in addition to the overlayer shifts and from this and the valance band spectra some estimate could be made of the bonding energy of the surface layer. Author

N86-22342# Brookhaven National Lab., Upton, N. Y.
STUDIES OF THE Ta(110) SURFACE AND HYDROGEN ON Ta(110)
M. W. Ruckman, V. Murgai, and Myron Strongin *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 115-117 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

The properties of hydrogen on metal surface besides being of intrinsic scientific interest, are also important to any understanding of hydrogen uptake in metals. Before the hydrogen features themselves can be studied, there must be some understanding of the features of the clean Ta(110) surface, and various measurements have been made of Ta(110) in normal photoemission. Author

N86-22343# Brookhaven National Lab., Upton, N. Y.
CARBON K-EDGE X-RAY ABSORPTION SPECTROSCOPIC STUDIES OF STRUCTURE AND ELECTRONIC PROPERTIES OF HYDROCARBONS ADSORBED ON Ni CRYSTAL SURFACES
T. K. Sham, R. G. Carr (Stanford Synchrotron Radiation Lab., Calif.), W. Eberhardt (Exxon Research and Engineering Co., Annandale, N.J.), R. Garrett (State Univ. of New York, Stony Brook), E. Baldwin (Harvard Univ., Cambridge, Mass.), and C. M. Friend (Harvard Univ., Cambridge, Mass.) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 118-120 refs (For primary document see N86-22326 12-73)
(Contracts DE-AC02-76CH-00016; DE-AC02-80ER-10750; Grant PRF ACS-1477GS)
Avail: NTIS HC A10/MF A01

Using the Plane Grating Monochromator of the U7A beamline at the National Synchrotron Light Source (NSLS), the carbon K-edge X-ray absorption spectra of a large number hydrocarbon molecules and their derivatives adsorbed on Ni single-crystal surfaces (Ni(111), Ni(110) and Ni(100)) have been examined. The molecules studied include saturated hydrocarbons C2H6 and C6H12, and unsaturated ones C2H4, C2H2, C6H6, C6H10, C5H5N and C5H5S. Under the experimental conditions (room temperature, saturated surface), it is found that all the C K-edge Near Edge X-ray Absorption Fine Structures (NEXAFS) of the surface species exhibit the 1s yields pi* and 1s yields sigma shape resonance characteristic of unsaturated molecules although an intense 1s yields pi* transition is not seen in the gas phase spectra for the saturated alkanes. some of the adsorbates also exhibit polarization dependent behavior in their C K-edge adsorption coefficient. Author

N86-22344# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
PHOTOEMISSION STUDY OF METAL-DOPED BETA-BORON THERMOELECTRIC MATERIALS Abstract Only
Joe Wong, G. A. Stack, and T. K. Sham (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 121 (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

In the period August 13 to 17, ten shifts on beam Line U-7 were assigned to perform photoemission measurements of V-doped boron materials. All the beam time, however, was consumed in detecting leaks in the experimental chamber. After all possible leaks were mended, the background pressure was still high and the beam time had expired. A major leak in the monochromator section was later detected. Author

N86-22345# IBM Watson Research Center, Yorktown Heights, N.Y.
OXIDATION OF GaSs(110) CLEAVED SURFACE
G. Hughes, R. Ludeke, G. Landgren, J. F. Morar, and J. Jordan *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 122-124 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The oxidation of the GaAs(110) surface has been the subject of considerable attention in both experimental and theoretical investigations. Despite the large number of studies there has not been any direct or conclusive evidence in support of a particular oxidation mechanism. A variety of models have been proposed in attempts to explain the experimental results; however, in the case of photoemission studies, these explanations have to some degree been limited by the spectral resolution of the original data. The first results of a high resolution photoelectron spectroscopy study of cleaved GaAs(110) surfaces exposed to oxygen carried out on the IBM beam line at the Light Source are presented. The good overall resolution of less than 0.2 ev for the gallium and arsenic 3d core levels and 0.7 ev for the oxygen 1s made possible the identification of a number of chemically shifted components not previously resolved. The tunability of the synchrotron radiation was utilized to obtain spectra with predominantly surface or bulk features. These results necessitate a major revision of current ideas about the oxidation mechanism for this surface. Author

N86-22346# IBM Watson Research Center, Yorktown Heights, N.Y.
POLYIMIDE AND THE POLYMER-METAL INTERACTION
J. L. Jordan, J. F. Morar, G. Hughes, R. A. Pollak, and F. J. Himpsel *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 125-127 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Understanding how metal films adhere to polymer surfaces is a task of great interest and importance to the semiconductor packaging industry. The types of chemical and physical interactions which occur at the interface determine the strength and stability of the metal-polymer bond. Earlier work has included several ESCA and UPS studies of clean and metal coated polyimide. The individual components in photoemission spectra for carbon, oxygen and nitrogen 1s core levels have been tentatively assigned and changes with metal coverage indicate that while Cu does not form chemical bonds with the polymer surface, Cr does. The use of synchrotron radiation for photoemission spectroscopy at the U8 Beamline at NSLS has several significant advantages over laboratory ESCA for studying this system. First, a resolution of 0.5-1.0 eV allows for a more accurate assignment and monitoring of peak positions and intensities as a function of metal coverage. Second, photon energy tunability makes a certain amount of depth profiling possible. Author

N86-22347# IBM Watson Research Center, Yorktown Heights, N.Y.
INVESTIGATIONS OF THE ETCHING CHEMISTRY OF ELEC-

TRONIC MATERIALS

F. R. McFeely, J. F. Morar, and F. J. Himpsel *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 128-130 ref (For primary document see N86-22326 12-73)

Avail: NTIS HC A10/MF A01

The production of VLSI devices involves the fabrication of silicon substrates with micron-scale anisotropic features incorporating a number of distinct materials, such as silicon regions of various electrical properties, grown or deposited insulating layers, and metallizations. Currently, a variety of plasma-based processes are used to achieve the requisite level of profile control. A common feature of these methods is that the reaction is effected by radical and ionic species in a fluorocarbon plasma. In order to begin to investigate some of the mechanisms involved in etching reactions, a series of experiments has been conducted probing the interaction between fluorine atoms (supplied by the dissociative chemisorption of XeF2) and the surfaces of silicon. The experiments were performed by exposing the clean substrates, either (111) wafers or ingots for cleaving, to XeF2 in a special dosing chamber. The samples were then transferred into the spectrometer chamber through a double vacuum lock after pumping away the residual XeF2. High resolution core level spectra were obtained by means of a two-dimensional display type photoemission spectrometer operating in conjunction with a three-meter toroidal grating monochromator situated at beam line UV-8 at NSLS.

F.M.R.

N86-22348# IBM Watson Research Center, Yorktown Heights, N.Y.

HIGH RESOLUTION PHOTOEMISSION INVESTIGATION: THE OXIDATION OF W

J. F. Morar, F. J. Himpsel, G. J. Hughes, J. L. Jordan, F. R. McFeely, and Guy Hollinge (Universite Claude Bernard, Lyon, France) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 131-133 (For primary document see N86-22326 12-73)

Avail: NTIS HC A10/MF A01

High resolution photoemission measurements of surface oxide layers on tungsten has revealed a set of well resolved core level shifts characteristic of individual metal oxidation states. Measurement and analysis of this type of data can provide specific and quantitative chemical information about surface oxides. The formation of bonds between transition metals and strongly electronegative elements such as oxygen and fluorine results in charge transfer with the effect of shifting the metal core electron binding energies. The magnitude of such shifts depends primarily on two factors; the amount of charge transfer and the screening ability of the metals electrons. The size of core-level shifts tend to increase with additional charge transfer and be decreased by screening. In the case of tungsten the amount of screening should be a function of oxygen content since the oxygen ties up free electrons which are effective at screening. A continuous change in the tungsten core level shifts is observed with increasing oxygen content, i.e., as the screening changes from that characteristic of a metal screened to that characteristic of an insulator unscreened. Author

N86-22349# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.

PHOTOIONIZATION OF LASER-EXCITED SODIUM ATOMS USING SYNCHROTRON RADIATION

J. M. Preses, C. E. Burkhardt (Missouri Univ., St. Louis), R. Corey (Missouri Univ., St. Louis), T. Daulton (Missouri Univ., St. Louis), D. Earsom (Missouri Univ., St. Louis), W. P. Garver (Missouri Univ., St. Louis), and J. J. Leventhal (Missouri Univ., St. Louis) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 134-135 refs (For primary document see N86-22326 12-73)

Avail: NTIS HC A10/MF A01

The absorption of electromagnetic energy by an atom produces either an energically excited atom or a positive ion and a free electron (or electrons). Experiments designed to study these bound-bound and bound-free transitions have been conducted for many years; the early results, especially those associated with bound-bound transitions, provided the impetus for the development of quantum physics. A great deal has been learned about bound-bound transitions, in both emission and absorption. In fact the energies of the most important of the discrete states of almost all atoms and many of their ions are accurately known. However, thorough studies of photoionization of only a relatively few atoms have been carried out. This is due largely to the lack of stable continuous sources of radiation covering the wavelengths corresponding to the range of atomic ionization potentials, approx. 500-3000 A (24.6-4.3 eV). The relatively recent availability of synchrotron radiation and laser light has made it possible to perform a great many new experiments of fundamental interest. The work being performed in this project is directed toward providing new information on atomic photoionization. Author

N86-22350# Los Alamos National Lab., N. Mex.

APPLICATIONS OF TUNABLE VUV RADIATION

C. R. Quick, Jr., J. J. Tiee, J. Preses (Brookhaven National Lab., Upton, N.Y.), and R. E. Weston, Jr. (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synghrotron Light Source (NSLS) 1984 p 136-137 ref (For primary document see N86-22326 12-73)

Avail: NTIS HC A10/MF A01

Synchrotron radiation in the 110-140 nm wavelength region has been used to produce electronically excited gas-phase radicals via photofragmentation of suitable radical precursors. To date, most of the effort has been directed towards the investigation of the photophysical properties of two different species: (1) C2H (C2CD) radicals, which are an important hydrocarbon combustion intermediate and yet their spectroscopy is poorly understood, and (2) CF3 radicals, which are of interest in a variety of chemical systems such as atmospheric chemistry, where they have been implicated in the stratospheric ozone depletion problem, and semiconductor device fabrication, where they are used as chemical etching ingredients. A brief summary of the experimental results obtained for each of these two radicals is given. Author

N86-22351# Yale Univ., New Haven, Conn. Dept. of Physics.

REFLECTANCE MEASUREMENTS OF ALUMINUM COATINGS AT 200 - 500 nm Abstract Only

Stephen F. Schaffner, Linas I. Simonaitis, Elizabeth B. Martin, Henry Kasha, and Richard C. Larsen (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 138 (For primary document see N86-22326 12-73)

Avail: NTIS HC A10/MF A01

The U9A beam line of NSLS equipped with a monochromator was used to measure the reflectance of mirror samples in the 200 - 500 nm wavelength range. This was done in conjunction with the construction of a Cherenkov detector for BNL - Yale AGS Experiment 780 (Search for rare decay modes of the neutral kaon) which is approved for a run in 1985, as a complement to tests done in the AGS test beam and optical tests at 337 nm using a nitrogen laser. The utmost efficiency of the Cherenkov counter is crucial for the success of the experiment, and it was therefore mandatory to assure that its light gathering power at the short-wavelength end of the range tested be as close to the design value as possible. The tests were very successful in that they helped select a thin aluminized mylar with close to 90% reflectance, and pointed out a problem which exists with a certain type of katadioptric mirror on which the reflective layer had been (poorly) deposited. Author

N86-22352# Brookhaven National Lab., Upton, N. Y.

UV-VUV CIRCULAR DICHROISM SPECTROMETER

D. J. Spandau, J. S. Gaffney, G. I. Senum, E. T. Premuzic, and P. A. Snyder (Florida Atlantic Univ., Boca Raton) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 139-140 refs Sponsored in part by DOE and National Science Foundation (For primary document see N86-22326 12-73)

Avail: NTIS HC A10/MF A01

An attachment to the National Synchrotron Light Source (NSLS)

beamline U9A was designed and constructed for the spectroscopic study of optically active compounds using circular dichroism (CD) in the vacuum ultra violet (VUV) region. Synchrotron radiation, which is highly linearly polarized upon extraction from the ring, enters a mirror box and passes through a LiF window which separates the ultra high vacuum VUV synchrotron ring from the experimental system vacuum. After exiting the LiF window the beam enters the monochrometer and is then focused into the experimental chamber. The linearly polarized, monochromatic light passes through a CaF2 quarter-wave photoelastic modulator (PEM) which alternately produces right- and left-handed circularly polarized light at a 50 kHz frequency. The modulated circularly polarized light enters the sample cell and the differential absorption of the left- and right-handed components by the optically active compound under study gives rise to a 50 kHz ac signal. This signal is superimposed on a much larger dc signal due to the total light striking the PMT. To extract the small CD ac signal, the dc voltage supplying the photomultiplier tube (PMT) is controlled and maintained by an automatic gain control feedback circuit, which automatically extracts and amplifies the 50 kHz ac signal. This is accomplished by feedback loop to the photomultiplier high voltage supply which compensates source dc variations due to sample absorption and light source variability. This system automatically normalizes the CD signal with respect to the total absorption of the sample. Author

N86-22353# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
THE LIFETIME OF THE FLUORESCENT EXCITED STATE OF SOLID, LIQUID AND VAPOR PHASE CYCLOHEXANE
M. A. Wickramaaratchi, J. M. Preses, R. A. Holroyd, and R. E. Weston *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 141-142 refs (For primary document see N86-22326 12-73)
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In early work, the fluorescence lifetimes of saturated hydrocarbons were estimated by fluorescence quenching and energy transfer measurements. These values are very inaccurate. In some studies, it was found that the lifetimes of some saturated hydrocarbon liquids are temperature dependent, and the lifetimes of others in the vapor phase are wavelength dependent. One of these is cyclohexane. One of the reasons for the discrepancies among these values could be due to variations in experimental conditions such as temperature and excitation energy, and another reason could be the difficulty of evaluating the short lifetime of a very weak emitter. In the present studies, therefore, the lifetime of cyclohexane in the liquid and solid phases was determined using synchrotron radiation and by systematically varying the temperature and the excitation energy and in the gas phase by varying the excitation energy. F.M.R.

N86-22354# Columbia Univ., New York. Dept. of Chemistry.
VUV OPTICAL PROPERTIES OF CADMIUM DIMETHYL Abstract Only
Q. Y. Yang, R. Bersohn, and J. Preses (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 143 (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

When photodissociating a molecular beam of Cd(CH3)2 with 193 nm light from an excimer laser intense Cd(3P1 yields 1S0) emission was seen at 326.1 nm. However the 6.42 eV energy of the photon was somewhat less than the 6.93 eV required for the reaction: Cd(CH3)2 yields 2CH3 + Cd(3p1). This paradox could be resolved by assuming either that the published thermochemical data was in error or that the excimer laser had effected a two photon transition. Radiation from the synchrotron, a weak source compared to the excimer, was shown to produce no measurable emission from Cd(CH3)2 over the range 250-150 nm. At the higher energies in this range, some of the excited states reached must correlate with Cd(3P1). The fact that this state is not observed implies highly efficient potential curve hopping, i.e., internal quenching. A rough VUV absorption spectrum was measured. Author

N86-22355# Columbia Univ., New York. Dept. of Chemistry.
PHOTODISSOCIATION OF VINYL CYANIDE Abstract Only
C. F. Yu, G. Ondrey, R. Bersohn, and J. Preses (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 144 (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The bond energies of cyanides can be determined by measuring the threshold energy for the process: R - CN + h mu yields R + CN(B sup 2 sigma) i,w., the upper limit determined in this process is close to the true value. This scheme is applied to molecules in which R = I, Cl, Br, H and CH3. Also of interest is the process: CH2 = CH - C + N + h mu yields CH2 = CH + CN(B sup 2 sigma). If the minimum energy for this reaction could be measured, the heat of formation of the vinyl radical could be determined using the known heats of formation of the CN radical and the parent vinyl cyanide. Unfortunately, in the wavelength region 200-105 nm, no emission was seen from vinyl cyanide. (An exceedingly weak emission excited by 121.6 nm light was previously observed). Similar negative results were obtained for phenyl cyanide, C6H5CN but for CH3CN complete agreement was obtained. The conclusion is that just as with Cd(CH3)2 there is very efficient internal quenching of the excited state. An alternative explanation is that photodissociation of vinyl cyanide in the VUV process HCN molecules but not CN radicals. Author

N86-22356# Columbia Univ., New York.
PRELIMINARY STUDIES ON THE ACETYLCHOLINE RECEPTOR BY VACUUM ULTRA-VIOLET CIRCULAR DICHROISM SPECTROSCOPY Abstract Only
Donna L. Mielke, B. A. Wallace, and John C. Sutherland (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 145 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Circular dichroism (CD) spectroscopic studies have been performed on the acetylcholine receptor (AChR) using conventional instrumentation. This instrumentation has had to reached a wavelength minimum of about 200 nanometers (nm). Vacuum ultra-violet (VUV) CD studies of the AChR will be useful because the low wavelength data provided is more sensitive than the higher (greater than 200 nm) wavelength data available from conventional CD instrumentation. VUV-CD spectroscopy was performed on reconstituted vesicle samples of purified AChR. The purpose of these preliminary trials was to ascertain whether the sample was amenable to VUV-CD and whether low (170-180 nm) wavelengths could be reached. Spectra were obtained for this sample, but the absorbing components of the sample buffer prevented the desired low wavelengths from being attained. After optimization of the buffer system, and with the use of Gray cells of various pathlengths, it is expected that low wavelength data collection will be possible. Author

N86-22357# Brookhaven National Lab., Upton, N. Y.
U9B: ULTRAVIOLET BIOPHYSICS
John Clark Sutherland *In its* Activity of the National Synchrotron Light Sources (NSLS) 1984 p 146-147 (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Station U9B at NSL has two spectrometers that exploit different features of synchrotron radiation. A vacuum spectrometer is devoted to circular dichroism and magnetic circular dichroism; it operates in the spectral range from 160 to 1600 nm. The second spectrometer uses the time structure of the synchrotron beam to measure fluorescence lifetimes and anisotropy. A rotatable mirror directs the photon beam to one or the other spectrometers. The vacuum spectrometer was used to measure the circular dichrosim of DNA's and proteins. The solution structure of repeating sequence nucleic acid copolymers (synthetic DNA's) was studied. A CD band near 200 nm was found to be diagnostic for the handedness of

the DNA double helix. Vacuum ultraviolet CD has proven a better indication of helical type than the longer wavelength conventional CD. The addition of a thermo-regulated sample holder permitted improved short wavelength penetration, reduced problems of bubble formation in short pathlength samples and sharpened spectral bands. The circular dichroism of the 1300 nm band of photooxidized photosynthetic reaction centers from Rhodopseudomonas viridis was measured. The fluorescence lifetime spectrometer became fully functional in 1984. A gating circuit was built to eliminate artifacts in the fast timing electronics. A systematic survey of the lifetimes of the amino acid tyrosine and a large number of chemically related compounds was begun. The results will provide information on the solution conformation of peptide hormones such as insulin. F.M.R.

N86-22358# Yale Univ., New Haven, Conn. Dept. of Physics.
THE EFFECTS OF AUTOIONIZATION ON THE ALIGNMENT OF Cd+(4d95s2,2D5/2)
Z. M. Goodman, C. D. Caldwell, and M. G. White (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 148-150 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The benchmark process for photoionization-induced alignment in atoms is the fluorescence decay of the excited d-hole states of Cd(+). Fluorescence polarization measurements, from which alignment is derived, have been made at the He I (2,3)- and Ne II (3) resonance lines, and recently, Kronast, et al., covered the region from threshold for 2D5/2 production at 705.1 A to 400 A. Although these authors see evidence for the presence of doubly excited autoionizing resonances, a detailed study of the variation of alignment through an autoionizing resonance has not been made. It is just such a measurement which is reported here. Author

N86-22359# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
APPLICATION OF VACUUM ULTRAVIOLET PHOTON BEAMS TO TRANSIENTS PRODUCED BY DISCHARGE-FLOW TUBE SOURCES: PHOTOIONIZATION EFFICIENCY SPECTRUM OF O2(1 DELTA g)
J. R. Grover, R. B. Klemm, and F. L. Nesbitt *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 151-153 refs (For primary document see N86-22326 12-73)
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The photoionization spectrum of a (1 delta g) oxygen was measured previously only over the limited range from its threshold at 11.09 eV up to the threshold for the ionization of the O2(x3sig-mag-) ground state at 12.071 eV. However, the availability of monochromatic photon beams of high intensity at the National Synchrotron Light Source and the development of efficient spectrum-stripping techniques now make it feasible to observe the photoionization of (1 delta g) oxygen in the presence of ground state oxygen. Therefore a wider span of photon energies can be covered than was heretofore possible. Also, the investigation of a transient species such as O2(a1 delta g) serves as a demonstration of the application of discharge flow tube techniques at synchrotron light beam lines to measure thermochemical properties and spectra of the radicals and highly reactive molecular fragments that are significant intermediates in flow tube studies of fast chemical reactions in the gas phase. Author

N86-22360# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
MEASUREMENT OF THE DISSOCIATION ENERGIES OF GAS PHASE NEUTRAL DIMERS BY A PHOTOIONIZATION TECHNIQUE
J. R. Grover, M. G. White, E. A. Walters (New Mexico Univ., Albuquerque), J. K. Newman (New Mexico Univ., Albuquerque), E. T. Hui (New Mexico Univ., Albuquerque), and P. F. Fernandez (New Mexico Univ., Albuquerque) *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 154-156 refs (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

A knowledge of the dissociation energies of weak polyatomic heterodimers in the gas phase provides extremely important information for the study of long range intermolecular forces, which study is crucial if chemical reactivity is to be understood in detail. Unfortunately, very few such dissociation energies are known because the measurements have been very difficult. To help alleviate this problem a photoionization technique has been developed for making these measurements that is proving to be fast, unambiguous, sensitive, accurate, and reasonably general. Author

N86-22361# New Mexico Univ., Albuquerque.
ENERGY FLOW IN VAN DER WAALS MOLECULES
E. A. Walters, J. K. Newman, E. T. Hui, P. F. Fernancez, J. R. Grover (Brookhaven National Lab., Upton, N.Y.), and M. G. White (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 157-159 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Energy disposal in isolated molecules and during collisions between molecules is fundamental to chemical processes. The high brightness of the synchrotron radiation from the stored electron beam of NSLS is used to probe energy flow in van der Waals molecules. These species are generally dimeric clusters of molecules bound together only by long range attractive forces collectively known as van der Waals forces. In many respects they resemble chemical reagents frozen at the stage of formation of collision complexes. This is a particularly significant stage at which to interrupt a chemical reaction and to probe the energy flow. The results of chemical reactions on energy migration in loosely bound systems are described. Author

N86-22362# Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
PHOTOELECTRON SPECTROSCOPY OF AUTOIONIZING RYDBURG STATES IN SMALL MOLECULES
M. G. White and J. R. Grover *In its* Activity on the National Synchrotron Light Source (NSLS) 1984 p 160-162 (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

Unlike Rydberg series involving promotion of the outermost valence electron, Rydberg states resulting from excitations of deeper lying valence orbitals usually lie above the ionization potential. Although the latter belong to the neutral excited state manifold, such super-excited Rydberg levels are likely to interact with the degenerate ionization continuum, leading to the well-known phenomenon of autoionization. Autoionizing Rydberg and non-Rydberg resonances have been identified and characterized for a large number of molecules by photoabsorption and photoionization (integrated) measurements. Their effect on the internal energy distribution of the resulting ions, however, has been difficult to study due to the lack of suitably intense laboratory light sources (below 1000 A) required for such detailed measurements. It is the aim of the present work to systematically measure the decay of selectively excited autoionizing Rydberg states in small molecules through use of photoelectron spectroscopy and the intense, tunable, narrow-band radiation from the U-1 beam line of NSLS. Such data provide the basis for understanding the complex interaction between the molecular ion core and photoexcited electron, which is responsible for the autoionization process. Author

N86-22363# Pennsylvania Univ., Philadelphia.
DEEXCITATION ELECTRON SPECTROSCOPY OF FREE AND COORDINATED CO **c74**
C. T. Chen, W. K. Ford, R. A. DiDio, E. W. Plummer, and W. Eberhardt (Exxon Research and Engineering Co., Annandale, N.J.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 163-165 refs (For primary document

see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The resonant absorption behavior of free and coordinated molecules can be readily measured with tunable soft X-ray sources. To study the electronic details of the molecule-substrate interaction, the de-excitation of molecules that have been resonantly excited can also be monitored. Deexcitation electron spectroscopy (DES) is the analysis of electrons emitted following the decay from a reasonantly excited neutral state, and is complementary to photoemission (PES) and Auger (AES) spectroscopies. This new technique is well-suited to the study of valence-charge redistribution and excited-state lifetimes in molecules. DES has been used to compare the decay channels of resonantly excited CO in two configurations: strongly bound in the carbonyl complex Cr(CO)6, and weakly adsorbed on Cu(110). The DES spectra of these two systems show large intensity variations characteristic of the bonding confiugrations. The 1Pi-3Pl splitting of CO following the C sub ls yields 2 pi transition can also be measured by a comparison of DES with PES. Author

N86-22364*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SURFACE SENSITIVE PHOTOEMISSION EXAFS: A NEW STRUCTURAL TOOL
K. M. Choudhary (Stevens Inst. of Tech., Hoboken, N.J.), G. M. Rothberg (Stevens Inst. of Tech., Hoboken, N.J.), M. L. denBoer, G. P. Williams (Polytechnic Inst. of New York, Brooklyn), M. H. Hecht, and I. Lindau (Stanford Electronics Labs., Calif.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 166-168 refs Sponsored in part by DOE and National Science Foundation (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

A new technique for surface EXAFS has been developed. In this technique the absorption fine structure is observed by monitoring the photoelectrons emitted from core levels as a function of photon energy. The surface sensitivity is achieved by detecting elastic photoelectrons that escape to the vacuum from a few atomic layers near the surface. EXAFS from Mn 3p and F2s outer core levels in MnF2 were measured, the results were compared with transmission EXAFS from Mn ls core level and good agreement was found. This development is significant because: (1) almost all elements have suitable core levels of low binding energy; (2) since photopeaks from adjacent core levels do not cross as the photon energy is varied, the limitations imposed on other surface EXAFS techniques by this interference is removed. Auger electrons, which have fixed kinetic energies and so can cross photopeaks, will generally have low energies if they originate from outer core levels and be unlikely to appear in the EXAFS region of kinetic energies, i.e., in excess of about 50 eV; (3) VUV light is used, which greatly extends the usable range of photon energies; (4) more than one element in a solid may be studied with the same monochromator. The experiments were carried out on the VUV beam line U14A at NSLS. Author

N86-22365# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
STUDIES OF THE ELECTRONIC STRUCTURE AND EXCITATION PROPERTIES OF VANADIUM-OXYGEN COMPOUNDS WITH TETRAHEDRAL AND OCTAHEDRAL V-O COORDINATION. PART 1: VANADIUM PENTOXIDE
I. M. Curelaru, K. S. Din, J. Barth (IBM Watson Research Center, Yorktown Heightrs, N.Y.), G. P. Williams (Brookhaven National Lab., Upton, N.Y.), and N. Lucas (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 169-170 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Vanadium-oxygen compounds are the subject of active current interest. The investigation of vanadium pentoxide is the first part of a larger project devoted to studies of five series of oxides, vanadates, and bronzes. Characteristic for all these materials is the enclosure of vanadium atoms within rigid oxygen cages with tetrahedral or octahedral V-O coordination. The previous XPS, EELS, and APS studies have revealed large final state many body effects in the highly localized excited configurations of the VO sub n ionic clusters. The present synchrotron radiation photoemission experiment is particularly interesting. Tuning through edges and detecting the decay products of various final state configurations should provide important information on the structure of orbitals and the excitation dynamics. The main objectives are: (1) to gain insight into the detailed electronic structure, bonding characteristics, and excitation properties of the studied materials; (2) to evaluate the photoionization cross sections of valence and shallow levels in the energy range from 20 to 200 eV; and (3) to study the phase instability of non-stoichiometric or open-structure compounds caused by particle (electron and/or ion) bombardment. Author

N86-22366# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
PHOTOEMISSION STUDIES OF I-II, I-III INTERMETALLIC COMPOUNDS WITH B32 (ZINTL) STRUCTURE. PART 1: LIAl
I. M. Curelaru, K. S. Din, G. P. Williams (Brookhaven National Lab., Upton, N.Y.), and N. Lucas (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 171-172 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The I-II, I-III intermetallic compounds with B32 (Zintl) structure have recently attracted considerable interest because one of the members of this family (LiAl) is a promising candidate for an electrode material in high energy density (lithium-sulfur) batteries. In addition, these materials are useful as solid blankets for nuclear reactors. The experimental and theoretical data obtained so far for these materials raise a number of problems that warrant a thorough consideration, among which: (1) the conductivity behavior (metallic in I-II compounds and p-type in I-III compounds); (2) the finite vacancy concentration in I-III compounds even at low temperatures; and (3) the discrepancies between the results of different band structure calculations, and their poor agreement with the reported experimental data. A systematic experimental study of the electronic structure of the occupied and empty states of representative compounds in the I-II and I-III series was recently begun by using the complementary information provided by a number of electron and X-ray spectroscopies, including XPS, EELS, AES, APS, and synchrotron radiation photoelectron and yield spectroscopies. Results follow. Author

N86-22367# State Univ. of New York, Stony Brook. Dept. of Chemistry.
PHOTON STIMULTED DESOPRTION OF IONS FROM POLYMER SURFACES
D. M. Hanson, S. L. Anderson, M. C. Nelson, G. P. Williams (Brookhaven National Lab., Upton, N.Y.), and N. Lucas (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 173-174 refs (For primary document see N86-22326 12-73)
(Grant NSF CHE-82-15061)
Avail: NTIS HC A10/MF A01

The desorption of ions from solid molecular films following deep valence or core level excitation using synchrotron radiation has been reported for a few relatively small molecules. Using the instrumentation on beamline UI4A of NSLS, the first results for the case of polymers have been obtained. Detailed studies were made of thin films of polystyrene and polyethylene, which were characterized by ion and electron yield spectra in the region of the carbon K edge. Author

N86-22368# Notre Dame Univ., Ind. Dept. of Chemistry and Radiation Lab.
RESONANCE VALENCE-BAND PHOTOEMISSION AND h Nu DEPENDENT 3p PHOTOEMISSION OF MnF2
R. G. Hayes and T. K. Sharn (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 175-177 refs (For

primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

This experiment was a preliminary part of a project which is concerned primarily with the h sub mu dependence of 3p photoemission in transition-element compounds. The primary objective of the work is to seek evidence for the presence of satellite structures in 3p photoemission. Examination of the resonance valence-band photoemission was undertaken because of the considerable recent interest in this phenomenon in compounds and because of the idea that the resonant part of the balance photoemission amplitude should be concentrated more in the ligand field states (that is, more in the states which are described in first approximation as d states) the more ionic the system. Author

N86-22369# Polytechnic Inst. of New York, Brooklyn.
RESONANT PHOTOEMISSION STUDIES OF f-ELECTRON SYSTEMS PERFORMED ON STATION U14
R. D. Parks, S. Raaen, M. L. denBoer, Y.-S. Chaug, and G. P. Williams (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 178-180 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

The study of the behavior of f-electrons in the early rare earths and early actinides has become an area of strong current interest. This results from (1) the anomalous nature of the 4f instability in mixed valent Ce-based systems, which appears to fall outside the usual promotional model description of mixed valence, and (2) the recent discovery of superconductivity in several Ce- and U-based (so-called heavy fermion) systems, where the effective mass of the electrons responsible for the superconductivity is of an order 200 times the free electron mass. F-Derived photoemission experiments allow one to observe the response of the electronic system to the presence of a 4f hole, this being of particular interest in the rare earths because of the Coulomb disturbance created by the deep core 4f hole. Moreover, these experiments reveal the juxtaposition of f-states and valence band states and allow the probing of hybridization effects between the f-electrons and conduction or ligand electrons. The use of a synchrotron light source allows one to employ Fano resonances which enhance the f-derived features, thereby allowing isolation of f-derived features from other features in the valence band. Author

N86-22370# IBM Watson Research Center, Yorktown Heights, N.Y.
CONTACT X-RAY MICROSCOPY OF BIOLOGICAL MATERIALS
Lorena Beese and Ralph Feder *In* Brookhaven National Lab. [Activity of the National Synchrotron Light Source (NSLS) 1986 p 181-182 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

In contact X-ray microscopy, X-rays pass through the biological sample and expose an underlying X-ray sensitive material (photoresist), producing an image that reflects the photon absorbance within the specimen. Because this absorbance is a function of the energy of the incident X-rays, tuneable synchrotron radiation can be used to vary the contrast in X-ray images, accentuating regions of different chemical composition. The technique is capable of resolution of the order of 100 A. Progress has been made toward automating the data collection process. A sample holder was developed that enables up to 28 different samples to be exposed sequentially. The X-ray wavelength and exposure for each sample can be pre-programmed and the experiment run under control of a microcomputer. Preliminary experiments have been made to assess the feasibility of using contact X-ray microscopy to determine the distribution of elements (differential absorption microanalysis) within biological samples. In principle, differences between images of samples exposed to wavelengths slightly above and slightly below the absorption edge of an element could be used to indicate the distribution and concentration of the element. Differences in contrast have been observed which may be correlated not only with elemental distribution, but also with the location of protein and lipid within the biological sample. Author

N86-22371# Brookhaven National Lab., Upton, N. Y.
X-RAY HOLOGRAPHY EXPERIMENTS ON THE U15 BEAM LINE
M. R. Howells and M. Larocci *In its* Activity of the National Synchrotron Light Source (NSLS) 1984 p 183-185 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

For many years scientists have tried to make a new and unique microscope by recording a hologram in the X-ray region and reconstructing it with visible light. This would be expected to give the superb, instant three dimensional picture typical of the holographic method plus the special information gathering properties of the X-ray probe. Under suitable conditions the magnification of the device should naturally be the ratio of the X-ray to visible light wavelength. This type of microscopy has not been realized due mainly to the poor coherence properties of microfocus X-ray tubes and other available sources. With the present rapid improvement of synchrotron radiation sources, the introduction of dedicated storage rings, and the demonstration of undulators in the soft X-ray region, sources of vastly greater coherent power and correspondingly improved possibilities for holographic microscopy are now available. Using the U15 beam line of NSLS, initial aim is to equal or surpass the performance (especially resolution) achieved in earlier experiments and to try to demonstrate that the understanding of X-ray holography is correct. To this end holograms have been made of various objects, mostly rather simple, so that there would be some possibility of comparison with theory. Author

N86-22372# State Univ. of New York, Stony Brook. Dept. of Physics.
SCANNING SOFT X-RAY MICROSCOPY ON THE U15 BEAM LINE
C. Jacobsen, J. M. Kenney, J. Kirz, R. Rosser, F. Cinotti (Brookhaven National Lab., Upton, N.Y.), and H. Rarback (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1985 p 186-188 Sponsored in part by National Science Foundation (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

Soft X-rays are well suited to the imaging of biological materials. The instrumentation for scanning microscopy has been developed and applied the apparatus to the study of a variety of specimens. The basic optical element in the microscope is a Fresnel zoneplate, fabricated for us at IBM using electron beam lithography techniques. This zoneplate is used to focus the X-ray beam to a 0.2 micrometer spot. The specimen is mechanically scanned past this spot, while the X-rays transmitted through it are detected by a flow proportional counter. The output from the counter is used to form the image, a map of the specimen absorptivity. Author

N86-22373# State Univ. of New York, Stony Brook. Dept. of Physics.
GAS PHASE SPECTROSCOPY IN THE SOFT X-RAY REGION OF THE U15 BEAMLINE
Bing Xin Yang, Janos Kirz, and Tsun K. Sham (Brookhaven National Lab., Upton, N.Y.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1985 p 189-190 refs Sponsored in part by National Science Foundation (For primary document see N86-22326 12-73)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A10/MF A01

The U15 beamline operates with a toroidal grating monochromator. It delivers a beam in the 300eV - 1200eV range with a typical bandwidth of 1/300. The experimental station is isolated from the storage ring by a 1500 A thick aluminum contamination barrier. These characteristics make it attractive to use the beamline for spectroscopy near the nitrogen and oxygen absorption edges, especially for specimens which are either gaseous or are incompatible with ultrahigh vacuum systems for other reasons. The hardware and the software to collect near edge and X-ray

Absorption Fine Structure (EXAFS) spectra of gases has been developed in three ways: (1) transmission; (2) ion yield; and (3) scintillation. During the development of the system data has been collected on a variety of materials, such as oxygen, carbon dioxide, water vapor, and ethyl alcohol. The thickness effect has been studied, and the relationship between the three types of spectra obtained. The spectra obtained on carbon dioxide are shown. The structure near the oxygen edge is in qualitative agreement with results obtained. Structure at higher energies is suggestive of EXAFS. Author

N86-22374 Pennsylvania Univ., Philadelphia.
SOME ASPECTS OF THE PHENOMENOLOGICAL AND MICROSCOPIC THEORY OF NUCLEAR COLLECTIVE MOTION Ph.D. Thesis
Dennis Bonatsos 1985 244 p
Avail: Univ. Microfilms Order No. jDA8523396

Low lying collective states in nuclei are described from the phenomenological and the microscopic point of view. First, the Variable Moment of inertia model was generalized so as to be applicable to transitional and vibrational nuclei. Two three-parameter models, the Variable Anharmonic Vibrator Model and the Generalized VMI model were introduced and applied to all known ground state bands of medium and heavy even nuclei away from closed shells. Except for strongly deformed nuclei, these models substantially improve the agreement with the data. Backbending in even nuclei is fitted next, by mixing a ground state, beta or gamma band with a superband characterized by a constant moment of inertia and applying either the standard band coupling formalism or the constant interband interaction formalism. An approximate method for carrying out the boson mapping in the seniority scheme is described, in which the boson expansion of the pair and multipole operators are determined by satisfying the commutation relations for the associated Lie algebra. A special closed set of communication relations satisfied by the fermion pair and multipole operators for a major shell in LST coupling is found. Dissert. Abstr.

N86-22375# Mission Research Corp., Santa Barbara, Calif.
MONTE CARLO CALCULATIONS ON THE DIRECT CABLE DRIVE DUE TO GAMMA RADIATION Technical Report, 30 Jun. - 1 Aug. 1984
Ed Kalasky 1 Dec. 1984 72 p
(Contract DNA001-81-C-0151; DA Proj. X99-QMXV)
(AD-A161734; AD-E301842; MRC-R-835; DNA-TR-85-8) Avail: NTIS HC A04/MF A01 CSCL 20/14

Two Monte Carlo codes, labeled MCABLE and MCIMP, were developed to determine the direct drive currents in cables due to gamma radiation. MCABLE was written in cylindrical coordinates for circular shaped cables and MCIMP in Cartesian coordinates for any arbitrary shape. A background into single and multiple scattering theory with an emphasis on the Moliere and Scott-Snyder distribution functions is presented. Range and emission current calculations are provided to substantiate the validity and accuracy of the technique used in the Monte Carlo codes. An experimental comparison was also made to verify the accuracy of the codes. A parametric study was conducted on the response of a coaxial cable due to variations in the dimensions and material types. Based on this study, a simple model for estimating the shield and center conductor currents is presented. Finally, a comparison is made between the response of eight cables measured in the laboratory and the Monte Carlo code MCABLE. GRA

N86-22376# Berkeley Research Associates, Inc., Calif.
DEVELOPMENT OF RESEARCH TOOLS TO STUDY STRUCTURE AND EVOLUTION IN THE INTERMEDIATE ALTITUDE REGIME Final Technical Report, 1 Nov. 1983 - 31 Oct. 1984
Stephen H. Brecht 22 Jan. 1985 29 p
(Contract DNA001-84-C-0018)
(AD-A162707; AD-E301861; BRA-85-496R; DNA-TR-85-63) Avail: NTIS HC A03/MF A01 CSCL 18/3

This report covers the initial research on alternative methods to study aspects of the nonlinear dynamics of low and intermediate altitude fireballs. The research consisted of developing a 2-D vertex-in-cell code, VINCE, and examining the flow field interaction of some simple multiple burst scenarios during the rise and torusing phase of the dynamics. This code will allow the study of a variety of potential structure mechanisms. It was determined that a 3-D version of this code was possible. A final aspect of the research reported here was a cursory study of the problem of small scale structure convention in large codes. Some speculative ideas are presented. GRA

N86-22377# California Univ., Los Angeles. School of Engineering and Applied Science.
HIGH REPETITION RATE ELECTRON BEAM RF-ACCELERATION AND SUB-MILLIMETER WAVE GENERATION VIA A FREE ELECTRON LASER Annual Progress Report, 15 Aug. 1984 - 14 Aug. 1985
N. C. Luhmann, Jr. and D. B. McDermott 14 Aug. 1985 22 p
(Contract N00014-84-K-0569)
(AD-A162791) Avail: NTIS HC A02/MF A01 CSCL 20/5

A Radiofrequency linac has been constructed which is specifically designed for Free electron laser applications. The shunt resistance is moderate, thereby allowing the acceleration of relatively high beam currents (somewhat 1 A) which will result in moderate FEL gains (somewhat 10 dB). Numerical simulation of the single-cavity TM sub 010 linear accelerator has been performed to determine the optimum cavity length. For this value, optimally phased electrons cross the cavity in one half of the RF cycle. This length is dependent on both the input and desired output energies. For the calculations 10 kV was chosen as the input electron energy and 725 kV as the output energy in order to amplify 94 GHz radiation with a 3.0 cm period wiggler. GRA

N86-22378# Oak Ridge National Lab., Tenn.
(252)Cf-SOURCE-DRIVEN NEUTRON NOISE ANALYSIS METHOD
J. T. Mihalczo, W. T. King, and E. D. Blakeman 1985 32 p Presented at the DOE Subcritical Reactivity Measurements Workshop, Albuquerque, N. Mex., 26 Aug. 1985
(Contract DE-AC05-84OR-21400)
(DE85-018094; CONF-8508105-4) Avail: NTIS HC A03/MF A01

The Cf-252-source-driven neutron noise analysis method has been tested in a wide variety of experiments that have indicated the broad range of applicability of the method. The neutron multiplication factor k(sub eff) has been satisfactorily determined for a variety of materials including uranium metal, light water reactor fuel pins, fissile solutions, fuel plates in water, and interacting cylinders. For a uranyl nitrate solution tank which is typical of a fuel processing or reprocessing plant, the k(sub eff) values were satisfactorily determined for values between 0.92 and 0.5 using a simple point kinetics interpretation of the experimental data. The short measurement times, in several cases as low as 1 min, have shown that the development of this method can lead to a practical subcriticality monitor for many in-plant applications. The further development of the method will require experiments oriented toward particular applications including dynamic experiments and the development of theoretical methods to predict the experimental observables. DOE

N86-22379# Hanford Engineering Development Lab., Richland, Wash.
PERFORMANCE TESTING OF REFRACTORY ALLOY-CLAD FUEL ELEMENTS FOR SPACE REACTORS
D. S. Dutt, C. M. Cox, R. A. Karnesky, and M. K. Millhollen 1985 9 p Presented at the 20th Intersociety Energy Conversion Engineering Conference, Miami Beach, Fla., 18 Aug. 1985
(Contract DE-AC06-76FF-02170)
(DE85-018209; HEDL-SA-3347-FP; CONF-850808-25) Avail: NTIS HC A02/MF A01

Two fast reactor irradiation tests, SP-1 and SP-2, provide a unique and self-consistent data set with which to evaluate the technical feasibility of potential fuel systems for the SP-100 space reactor. Fuel pins fabricated with leading cladding candidates (Nb-1Zr, PWC-11, and Mo-13Re) and fuel forms (UN and UO2)

are operated at temperatures typical of those expected in the SP-100 design. The first US fast reactor irradiated, refractory alloy clad fuel pins, from the SP-1 test, reached 1 at. % burnup in EBR-II in March 1985. At that time selected pins were discharged for interim examination. These examinations confirmed the excellent performance of the Nb-1Zr clad uranium oxide and uranium nitride fuel elements, which are the baseline fuel systems for two SP-100 reactor concepts. DOE

N86-22380# California Univ., Santa Barbara. Dept. of Electrical and Computer Engineering.
ELECTRON ACCELERATION BY LASER FIELDS IN A GAS Technical Progress Report
J. R. Fontana 1 Oct. 1985 50 p
(Contract DE-AS03-84ER-40136)
(DE86-000983; DOE/ER-40136/T3) Avail: NTIS HC A03/MF A01

The interaction of an electron with laser radiation within an optical waveguide is discussed. The use of cylindrical waveguides allows extension of the interaction region beyond the distance imposed by the geometrical constraints of Cherenkov angle and beam width. The guide loss depends on the mode and the nature of the wall. Numerical examples are given. Results of computer simulations of electron trajectories under simultaneous acceleration and gas deflection collisions are given. A conference paper describes the use of interactions between laser fields and charged relativistic particles inside a passive gas medium for high-energy acceleration. Suitable geometrical configurations are discussed quantitatively, and consideration is given to gas breakdown and collision effects. It is shown how currently available laser powers can yield large electron acceleration gradients and total energy gain while controlling beam spreading by the inherent focusing properties of the fields. Another paper proposes a scheme using the inverse Cherenkov effect to focus particle beams with the potential of high focusing gradients and rapid, accurate control of the focusing elements. DOE

N86-22381# Tennessee Univ., Knoxville. Dept. of Physics.
BUBBLE CHAMBER STUDIES OF HADRON AND PHOTON INTERACTIONS Progress Report, 1 Oct. 1984 - 30 Sep. 1985
W. M. Bugg, J. E. Brau, G. T. Condo, T. Handler, and E. L. Hart Oct. 1985 44 p
(Contract DE-AS05-76ER-03956)
(DE86-002513; DOE/ER-03956/4) Avail: NTIS HC A03/MF A01

The past year has been a hectic one with extended runs at Fermilab and SLAC, equipment design and construction, and installation of holographic scanning devices at Tennessee. Highlights include data analysis on charm and non-charm parts of BC72-73-75 by Brau, Condo and Handler, and solid proof of feasibility of holographic bubble chamber techniques for large bubble chambers by E745. However, the most important contribution of the Tennessee Group was to calorimetry for the SLD detector. Almost two years after his bold and independent initiative within the SLD collaboration, the calorimetry studies of Jim Brau supported consistently by tests of four different calorimeters by the SLD collaboration, has resulted in a decision to build the SLD calorimeter out of lead rather than uranium. This will result in a net savings of nearly 1.5 million dollars with negligible degradation in performance characteristics. DOE

N86-22382# Illinois Univ., Urbana. Fusion Studies Lab.
ALPHA-PARTICLE-DRIVEN INSTABILITY OF ALFVEN WAVES IN A TANDEM MIRROR Final Summary Report, 21 Feb. - 20 May 1985
S. K. Ho 20 Aug. 1985 21 p
(Contract W-7405-eng-48)
(DE86-000741; UCRL-15719) Avail: NTIS HC A02/MF A01

Alpha particles born at D-T fusion are mirror confined in the tandem mirror due to their relatively high energy. Therefore, they have a loss-cone type distribution in the velocity space. This anisotropy is susceptible to microinstability. The objective of this work is to study the possible instability that can be driven by the alpha loss-cone. The low frequency (at the order of the ion cyclotron frequency) wave spectrum is studied to seek the waves that can be destabilized by the alphas. The radial mode structure is found for the growth rate calculation. The alpha particle distribution with a loss-cone is obtained from a Legendre function expansion and a diffusion front method. The growth rate of the instability is formulated from linear stability theory and computed numerically. A marginal stability boundary in the ion density and temperature parameters is calculated. DOE

N86-22383# Los Alamos National Lab., N. Mex.
LAMPF: ITS ORIGINS, HISTORY, AND ACCOMPLISHMENTS
L. Rosen 1985 26 p refs Presented at the Kyoto International Symposium: The Jubilee of the Meson Theory, Kyoto, Japan, 15 Aug. 1985
(Contract W-7405-eng-36)
(DE86-000814; LA-UR-85-3340; CONF-8508120-2) Avail: NTIS HC A03/MF A01

The main vehicle for bringing the pion to bear on a vast array of problems has been the meson factories. Today there exist such facilities in Switzerland (SIN), in Canada (TRIUMF), and in the USA (LAMPF). A fourth is just now being completed in the Soviet Union. They are enormous enterprises - the current replacement value of LMPF is $350 million, not including the part devoted to national security problems. But they accommodate hundreds of scientists from around the world and by so doing generate political as well as intellectual and economic capital. Proton facilities, together with heavy-ion accelerators and electron facilities, form a triad on which stands the present edifice of experimental nuclear science. Each leg of this triad is dependent, to a greater or lesser extent, on the other two. However, in terms of versatility, the size of the community it serves, and the relatively short-term application of the knowledge base and people base for which nuclear science is responsible, the meson factory part of the above triad is by no means the least important component. I discuss this component from the standpoint of the facility I know best, namely LAMPF. DOE

N86-22384# California Univ., Berkeley. Lawrence Berkeley Lab.
FLOW OF NUCLEAR MATTER
H. G. Ritter, K. G. R. Doss, H. A. Gustafsson, H. H. Gutbrod, K. H. Kampert, B. Kolb, H. Loehner, B. Ludewigt, A. M. Poskanzer, and A. Warwick Aug. 1985 9 p refs Presented at the 2nd International Conference on Nucleus-nucleus Collisions, Visby, Sweden, 10 Jun. 1985 Prepared in cooperation with Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)
(Contract DE-AC03-76SF-00098)
(DE86-001484; LBL-20086; CONF-850672-5) Avail: NTIS HC A02/MF A01

The systems Nb + Nb and Au + Au have been measured at different energies at the Bevalac with the Plastic Ball spectrometer. Distributions of the flow angles as a function of charged particle multiplicity are presented. Also shown is a transverse momentum analysis for 400 MeV per nucleon Nb + Nb. DOE

N86-22385# Lawrence Livermore National Lab., Calif.
NUMERICAL SIMULATION OF AN ACCELERATOR INJECTOR
J. K. Boyd, G. J. Caporaso, and A. G. Cole May 1985 13 p Presented at the Particle Accelerator Conference, Vancouver, Canada, 13 May 1985
(Contract W-7405-eng-48)
(DE86-001572; UCRL-91878; CONF-850504-291) Avail: NTIS HC A02/MF A01

Accelerator injector designs have been evaluated using two computer codes. The first code self consistently follows relativistic particles in two dimensions. Fields are obtained in the Darwin model which includes inductive effects. This code is used to study cathode emission and acceleration to full injector voltage. The second code transports a fixed segment of a beam along the remainder of the beam line. Using these two codes the effects of electrode configuration on emittance, beam quality and beam transport have been studied. DOE

N86-22386# Lawrence Livermore National Lab., Calif.
RECENT PROGRESS OF THE ADVANCED TEST ACCELERATOR
D. S. Prono 13 May 1985 21 p refs Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-48)
(DE86-001578; UCRL-91940; CONF-850504-288) Avail: NTIS HC A02/MF A01

Attempts to further improve the beam brightness from field emission cathodes are currently centered on the issue of how beam optics and phase mixing within the injector transport tend to average down the beam brightness. Particle simulation work indicates that beam brightness can be significantly improved by simply reducing the injector transport magnetic field and losing peak transport current, i.e., only transporting that high brightness portion of the total current. The simulation results shown in Figure 8 suggest that beam brightness can be increased perhaps a factor of 5 or more simply by tuning for brightness rather than tuning for peak transported current. If this can indeed be experimentally realized and the resulting beam matched onto accelerator transport (magnetic and/or laser guided) without emittance degradation then simple field emission cathodes would, at least in the immediately near term, saisfy the needs for 10 micron FEL experiments. DOE

N86-22387# Lawrence Livermore National Lab., Calif.
ANALYTICAL METHODS OF ELECTRODE DESIGN FOR A RELATIVISTIC ELECTRON GUN
G. J. Caporaso, A. G. Cole, and J. K. Boyd May 1985 9 p refs Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985 Previously announced in IAA as A86-10784
(Contract W-7405-eng-48)
(DE86-001584; UCRL-91912; CONF-850504-292) Avail: NTIS HC A02/MF A01

The paraxial approximation is used to derive a differential equation for the applied potential in a relativistic electron gun. The equation incorporates the effects of the beam's own azimuthal magnetic field. The equation is applied to the cases of a parallel beam and an exponentially converging beam. When the paraxial approximation is valid, the solutions provide reasonably accurate results in terms of expected current and axial placement of electrodes. C.D.

N86-22388# Virginia Polytechnic Inst. and State Univ., Blacksburg.
STUDIES OF e(+)e(-) INTERACTIONS Progress Report, Jan. - Dec. 1984
A. Abashian Aug. 1985 12 p
(Contract DE-AS05-80ER-10713)
(DE86-001656; DOE/ER-10713/4B) Avail: NTIS HC A02/MF A01

Virginia Polytechnic Institute and State University has assumed primary responsibility for the design, construction, and testing of an electromagnetic calorimeter which is the primary device for the detection of electrons and photons in the planned AMY detector at TRISTAN. The design of the calorimeter began together with a program of prototyping of components. Several questions regarding the configuration of the detector are discussed. The development of fabrication techniques for the calorimeter and the design and construction of fabrication fixtures are reported. DOE

74 OPTICS

Includes light phenomena.

N86-22389 Stanford Univ., Calif.
ALL-FIBER-OPTIC GYROSCOPE WITH EXTENDED LINEAR DYNAMIC RANGE Ph.D. Thesis
Byoung Yoon Kim 1985 161 p
Avail: Univ. Microfilms Order No. DA8522172

The single mode fiber optic gyroscope is a potential alternative to mechanical and ring laser gyroscopes in many application areas. The fiber optic gyroscope becomes practical only when the periodic response of the interferometer to the rotation rate is linearized over a wide dynamic range. A number of methods that provide a wide linear dynamic range without complicating the optical circuit of an all fiber optic gyroscope are described. One approach to getting a linear dynamic range is to operate the gyroscope in a closed loop mode where a nonreciprocal phase shifter provides a cancellation of the rotation induced phase shift. Three different ways of getting a linear scale factor using a fiber optic phase modulator in place of a nonreciprocal phase shifter are described. Another approach is to translate the optical phase difference in the interferometer into a phase shift in a low frequency electronic signal using an optical phase modulation in conjunction with simple electronic signal processing. Dissert. Abstr.

N86-22390*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL ELEMENTS FORMED BY COMPRESSED GASES: ANALYSIS AND POTENTIAL APPLICATIONS
Walton L. Howes 1986 24 p refs
(NASA-TP-2555; E-2561; NAS 1.60:2555) Avail: NTIS HC A02/MF A01 CSCL 20F

Spherical, cylindrical, and conical shock waves are optically analogous to gas lenses. The geometrical optics of these shock configurations are analyzed as they pertain to flow visualization instruments, particularly the rainbow schlieren apparatus and single-pass interferometers. It is proposed that a lens or mirror formed by gas compressed between plastic sheets has potential as a fluid visualization test object; as the objective mirror in a very large space-based telescope, communication antenna, or energy collector; as the objective mirror in inexpensive commercial telescopes; and as a component in fluid visualization apparatuses. Author

N86-22391 Stanford Univ., Calif.
RAMAN HETERODYNE INTERFERENCE PHENOMENA Ph.D. Thesis
Emily S. Kintzer 1985 107 p
Avail: Univ. Microfilms Order No. DA8522174

A laser spectroscopic technique was recently introduced that permits highly sensitive optical detection of nuclear magnetic resonance. This optical heterodyne technique is based on the coherent Raman effect and was demonstrated successfully in hyperfine structure of praseodymium in different crystal hosts, lanthanum trifluoride and yttrium aluminum perovskite. The interference that occurs in the Raman heterodyne technique is a consequence of the linear dependence of the signal on the three participating matrix elements, enabling the detection of relative phases as well as amplitudes. The nature of the interference was fully explored both in experiment and theory. Presented here are the experimental results showing interference between inequivalent nuclear sites and also between Zeeman components of a single site. The results show important differences in the interference behavior of praseodymium in the two crystals. Dissert. Abstr.

N86-22392# Technion - Israel Inst. of Tech., Haifa.
MEASUREMENT OF ATMOSPHERIC TRANSMISSION OVER LONG PATHS IN THE INFRARED SPECTRAL REGION Final Scientific Report, 1 Jan. 1984 - 31 Mar. 1985
U. P. Oppenheim and S. G. Lipson 15 Apr. 1985 21 p
(Grant AF-AFOSR-0023-83)
(AD-A161258; AFOSR-85-0890TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

A field experiment on atmospheric transmission over long paths in the infrared spectral region was carried out in the coastal plain of Israel, near the settlement of Palmachim, about 20 km south of Tel Aviv. The Palmachim experiment was carried out over a north-south optical path of 8.6 km length, along the shore of the mediterranian. The black-body source was kept at 2100 C and the dual-channel spectroradiometer was used to measure the spectrum, using circular variable filters with 4% resolution. GRA

N86-22393# City Coll. of the City Univ. of New York. Dept. of Electrical Engineering.
OPTICAL ACQUISITION, IMAGE AND DATA COMPRESSION Final Technical Report, 1 Mar. 1983 - 31 May 1985
George Eichmann Jul. 1985 99 p
(Grant AF-AFOSR-0081-83)
(AD-A161650; AFOSR-85-0971TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

The Hough transform (HT) is an efficient shape detector that maps straight lines into a two-parameter feature shape. Recently it has been pointed out that the forward Radon transform (FRT), well known from the theory of computed tomography, and the HT are equivalent for binary images. In this paper, analog coherent optical implementation of the FRT is discussed. The FRT will not only be of use in implementing the HT shape descriptors but also act as a coherent optical preprocessor for the implementation of multidimensional convolution, correlation, and spectral analysis using !-D acoustooptical signal processing devices. Several different coherent optical FRT architectures are presented. Experimental results using conventional coherent Fournier transform configuration are given. The relationship between the coherent optical implementation of the FRT and the inverse Radon transform, an important tool in computed tomography, is also detailed. GRA

N86-22394# Naval Weapons Center, China Lake, Calif.
THE ASYMPTOTIC BEHAVIOR OF AN EXPONENTIAL-TYPE SERIES Final Report, Jan. - Jun. 1985
William O. Alltop and Charles S. Kenney Oct. 1985 9 p
(ZR0-0001)
(AD-A162574; AD-E900528; NWC-TP-6662) Avail: NTIS HC A02/MF A01 CSCL 20/6

The limit of a certain function of three variables is shown to be exponential in one variable and independent of the other two. The function is a generalization of an infinite series arising in the calculation of backscattering of sharp laser pulses in an infinite cloud of isotropic scatterers. Convexity of the function in a particular region enables the evaluation of the asymptotic behavior without extensive algebraic manipulations. GRA

N86-22395# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
EDGE DETECTION
Ellen C. Hildreth Sep. 1985 22 p
(Contract N00014-80-C-0505)
(AD-A162662; AI-M-858) Avail: NTIS HC A02/MF A01 CSCL 20/6

For both biological systems and machines, vision begins with a large and unwieldly array of measurements of the amount of light reflected from surfaces in the environment. The goal of vision is to recover physical properties of objects in the scene such as the location of object boundaries and the structure, color and texture of object surfaces, from the two-dimensional image that is projected onto the eye or camera. This goal is not achieved in a single step: vision proceeds in stages, with each stage producing increasingly more useful descriptions of the image and then the scene. The first clues about the physical properties of the scene are provided by the changes of intensity in the image. The importance of intensity changes and edges in early visual processing has led to extensive research on their detection, description and use, both in computer and biological vision systems. This article reviews some of the theory that underlies the detection of edges, and the methods used to carry out this analysis. GRA

N86-22396# Department of the Air Force, Washington, D.C.
HYBRID SINGLE CRYSTAL OPTIC FIBERS BY GROWTH SOLUTION Patent Application
Stephen C. Rand, inventor (to Air Force) Filed 1 Oct. 1985 9 p
(AD-D011979; US-Patent-Appl-SN-782335) Avail: NTIS HC A02/MF A01 CSCL 20/6

This invention relates generally to glass fiber optics, and particularly, relates to a process of fabricating fibers useful in nonlinear optics applications. This abstract discloses a process of fabricating a hybrid single crystal fiber having nonlinear optical properties such as frequency doubling. Said process includes placing a fiber core upon a bulk nonlinear crystal such as LilO3 in a saturated growth solution of LilO3 in water. After the core is encased a sufficient distance crystal growth is stopped. Because of evanescent wave coupling between modes guided by the fiber, whose index of refraction exceeds that of the bulk nonlinear crystal, nonlinear optical polarizations can be generated in the nonlinear optical crystal which radiates new frequencies back into the guided modes. The fiber thereby acquires controllable nonlinear optical properties which glass fibers do not possess. GRA

N86-22397# Department of the Air Force, Washington, D.C.
A REAL-TIME PROGRAMMABLE OPTICAL CORRELATOR Patent Application
Francis T. S. Yu, inventor (to Air Force) Filed 22 Oct. 1985 19 p
(AD-D011990; US-Patent-Appl-SN-790292) Avail: NTIS HC A02/MF A01 CSCL 20/6

A real-time programmable joint transform optical correlator incorporating a magneto-optic spatial light modulator and a liquid crystal light valve therein. Object functions to be correlated are input into the magneto-optic spatial light modulator by a programmable microcomputer as input signals. Real time correlation takes place at the liquid crystal light valve with a coherent read out beam. Cross correlation between the input functions (signals) are obtained through the inverse Fourier transform of the read out coherent illumination and are subsequently output from the correlator. GRA

N86-22398# Department of the Air Force, Washington, D.C.
INFRARED SENSOR TARGET Patent Application
Charles N. Scully, inventor (to Air Force) Filed 26 Aug. 1985 20 p
(AD-D011996; US-Patent-Appl-SN-769114) Avail: NTIS HC A02/MF A01 CSCL 17/5

A target simulator device for simulating infrared radiation from infrared emitting targets. Such devices are often referred to as black body radiation sources and are employed as instruments for testing and calibrating infrared devices. In the present invention, the target simulator device or black body simulates given types of infrared radiation emitting targets and comprises, in general, a plate of beryllium oxide (BeO) mounted in a supportive case. It is provided with external power for heating the plate. The power consumed by heating the BeO plate of this invention amounts to only 44 percent of that required by a conventional commercial black body with the same effective target area. Author (GRA)

N86-22399# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kreiseltechnik und Traegheitsnavigation.
CONSTRUCTION OF FIBER OPTICS TWO-BEAM INTERFEROMETERS AND INVESTIGATIONS OF THE STRAIN AND TEMPERATURE SENSITIVITY
Norbert Fuerstenau Aug. 1985 47 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-980)
(DFVLR-FB-85-56; ISSN-0171-1342) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 18

Investigations on fiber optic Mach-Zehnder and Fabry-Perot interferometers are described as a first step in the development of a digital fiber optics control and sensor system. Measurements on laboratory setups yield a digital strain resolution of 0.56 micron count in agreement with the theoretically derived result. The measured temperature resolution is 0.04 Km/count per 1 m fiber, a value 20% lower as compared to the theoretical one. For automatic fringe counting the Mach-Zehnder setup was modified into a two-polarization type interferometer and its operation was tested by measuring strain and temperature characteristics.
Author (ESA)

N86-22279# Joint Publications Research Service, Arlington, Va.
STUDY OF THE KINETICS OF MOLECULAR NITROGEN BY

THE METHOD OF WIDE-BAND COHERENT ANTISTOKES SCATTERING OF LIGHT Abstract Only
A. A. Devyatov, S. A. Dolenko, and N. N. Roy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 27 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 281, no. 6, Apr. 1985 p 1355-1359 Original language document was announced in IAA as A85-35878 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22280# Joint Publications Research Service, Arlington, Va.
NONLINEAR OPTICAL SPECTROSCOPY OF PHONON POLARITONS Thesis - USSR Academy of Sciences Abstract Only
Yuriy Nikolayevich Polivanov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 28 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22281# Joint Publications Research Service, Arlington, Va.
DIAGNOSIS OF POPULATIONS AND RELAXATION PROCESSES OF VIBRATIONAL AND ROTATIONAL STATES OF MOLEUCLES IN GASES BY COHERENT ANTI-STOKES SCATTERING SPECTROSCOPY Thesis - USSR Academiy of Sciences Abstract Only
Viktor Immanuilovich Fabelinskiy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 29 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22282# Joint Publications Research Service, Arlington, Va.
INTENSE BEAMS OF COLD ATOMS FOR LASER SPECTROSCOPY Abstract Only
V. I. Balykin, V. C. Letokhov, V. G. Minogin, and A. I. Sidorov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 30 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Fizicheskaya (Moscow, USSR), vol. 49, no. 3, Mar.1985 p 479-486 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22283# Joint Publications Research Service, Arlington, Va.
DIFFRACTION EFFICIENCY OF HOLOGRAPHIC GRATINGS WITH SYMMETRICAL PROFILES Abstract Only
L. A. Dmitrieva, I. V. Golubenko, and G. M. Savitskin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 31 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 1, Jan. 1985 p 4-6 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22284# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF OPTICAL INHOMOGENEITY OF CYLINDRICAL BODIES BY LIGHT BEAM DEFLECTION Abstract Only
Kh. K. Aben, S. I. Idnurm, Yu. I. Iozepson, M. S. Kaplan, and S. A. Malinovskaya *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 32 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 1, Jan. 1985 p 7-9 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22285# Joint Publications Research Service, Arlington, Va.
ENHANCING EFFICIENCY OF ATOM IONIZATION BY PULSED PERIODIC LASERS Abstract Only
S. V. Andreev, V. I. Minshin, and S. K. Sekatskiy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 33 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 3(153), Mar. 1985 p 611-614 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22286# Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF COMPENSATING SMALL-SCALE INHOMOGENEITIES BY A ZERNIKE CELL Abstract Only
V. Ye. Sherstebitov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 34 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 91-95 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22287# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF UNIVERSAL INTRAMOLECULAR INTERACTIONS ON LASER RADIATION FROM OXAZINE 17 Abstract Only
N. V. Korolkova, N. V. Kurokhtin, and B. M. Uzhinov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 35 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 96-98 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22288# Joint Publications Research Service, Arlington, Va.
RADIATION FOCUSING BY PRISM RASTER Abstract Only
A. S. Dementyev and D. P. Domarkene *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 36 Transl. into ENGLISH from Kvantovaya Elektronika (Moscow, USSR), v. 12, no. 1, Jan. 1985 p 197-201 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22289# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF FLUORESCENCE KINETICS OF DYES BY PARAMETRIC FREQUENCY CONVERSION Abstract Only
S. A. Pleshanov and V. V. Shuvalov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 37 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta Seriya 3: Fizika Astronomiya (Moscow, USSR), v. 26, no. 2, Mar. - Apr. 1985 p 63-66 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22363# Pennsylvania Univ., Philadelphia.
DEEXCITATION ELECTRON SPECTROSCOPY OF FREE AND COORDINATED CO
C. T. Chen, W. K. Ford, R. A. DiDio, E. W. Plummer, and W. Eberhardt (Exxon Research and Engineering Co., Annandale, N.J.) *In* Brookhaven National Lab. Activity of the National Synchrotron Light Source (NSLS) 1984 p 163-165 refs (For primary document see N86-22326 12-73)
Avail: NTIS HC A10/MF A01

N86-22491*# Northwestern Univ., Evanston, Ill. Dept. of Physics and Astronomy.
ELECTROFORM REPLICATION OF GRAZING INCIDENCE X-RAY OPTICS
M. P. Ulmer, W. R. Purcell, D. Bedford (Birmingham Univ., England), and G. R. Simnett (Birmingham Univ., England) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 195-198 ref Sponsored by UK Science and Engineering Research Council (For primary document see N86-22461 12-89)
(Grant NAG5-181)
Avail: NTIS HC A14/MF A01

N86-22493# Danish Space Research Inst., Lyngby.
THE XMM IMAGING BRAGG SPECTROMETER WITH A DOUBLY CURVED CRYSTAL
B. Byrnak, F. E. Christensen, N. J. Westergaard, and H. W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 209-212 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22498# California Univ., Berkeley. Dept. of Physics.
THE APPLICATION OF REFLECTION GRATINGS TO A LARGE AREA X-RAY SPECTROSCOPY MISSION: A DISCUSSION OF SCIENTIFIC REQUIREMENTS AND VARIOUS DESIGN OPTIONS

Steven M. Kahn and Michael C. Hettrick *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 237-244 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22500# Columbia Univ., New York. Astrophysics Lab.
X-RAY POLARIMETRY ON XMM
R. Novick, G. Chanan, and D. J. Helfand *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 265-275 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-22400 Stanford Univ., Calif.
MEASUREMENTS OF MAGNETOACOUSTIC WAVES IN MHD PLASMAS Ph.D. Thesis
Archibald Currie Munce, Jr. 1985 267 p
Avail: Univ. Microfilms Order No. DA8522202

The results of the interaction between the electromagnetic fields and the acoustic and entropy waves in a partially ionized gas are presented. The effects of this interaction were measured and analyzed for combustion driven magnetohydrodynamic (MHD) generators. The solutions of an MHD dispersion relationship were examined to analyze the effects that the various different MHD operating parameters have upon the three types of waves, with emphasis on both the magnetoacoustic phase velocities, and wave amplitudes. The analysis was facilitated by the introduction of a nondimensional frequency which incorporates the effects of frequency and the magnetic interaction parameter in one variable. The limitations of a dispersion relationship analysis were discussed in detail, including some limitations which were not previously investigated. The experimental results demonstrate that there is an MHD interaction effect on the acoustic waves and that the magnitude of the effect is in good agreement with the predicted results based on the solutions of the MHD dispersion relationship and the acoustic model of the MHD flowtrain. Dissert. Abstr.

N86-22401 Stanford Univ., Calif.
FAR INFRARED DIAGNOSTICS OF ELECTRON CONCENTRATION IN COMBUSTION MHD PLASMAS USING INTERFEROMETRY AND FARADAY ROTATION Ph.D. Thesis
Paul John Kuzmenko 1985 309 p
Avail: Univ. Microfilms Order No. DA8522182

The plasma electrical conductivity is a key parameter in determining the efficiency of an magnetohydrodynamic (MHD) generator. Electromagnetic waves offer an accurate, non-intrusive probe. The electron concentration and mobility may be deduced from the refractive index and absorption coefficient measured with an interferometer. The first experiment used an HCOOH laser at 393.6 microns feeding a Michelson interferometer mounted around a combustor duct with open ports. Simultaneous measurements of positive ion density and plasma temperature made with a Langmuir probe and line reversal apparatus verified the operation of the interferometer. With a magnetic field present, measurement of the polarization rotation and induced ellipticity in a wave traveling along the field provides information on the plasma conductivity. Compared to interferometry, diagnostic apparatus based on Faraday rotation offers simpler optics and requires far less stringent mechanical stability at a cost of lower sensitivity. An advanced detection scheme, using a polarizing beam splitter improved the sensitivity to be comparable to that of interferometry. Interferometry is the preferred technique for small scale, high accuracy measurements, with Faraday rotation reserved for large systems or measurements within a working generator. Dissert. Abstr.

N86-22402# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORY FOR RESONANT ION ACCELERATION BY NONLINEAR MAGNETOSONIC FAST AND SLOW WAVES IN FINITE BETA PLASMAS
Yukiharu Oshawa Nov. 1985 40 p refs
(IPPJ-751) Avail: NTIS HC A03/MF A01

A Korteweg de-Vries equation that is applicable to both the nonlinear magnetosonic fast and slow waves is derived from a two-fluid model with finite ion and electron pressures. As in the cold plasma theory, the fast wave has a critical angle theta(c). For propagation angles greater than theta(c) (quasi-perpendicular propagation), the fast wave has a positive soliton, whereas for angles smaller than theta(c), it has a negative soliton. Finite Beta effects decrease the value of theta(c). The slow wave has a positive soliton for all angles of propagation. The magnitude of resonant ion acceleration (the upsilon (p) x B acceleration) by the nonlinear fast and slow waves is evaluated. In the fast wave, the electron pressure makes the acceleration stronger for all propagation angles. The decrease in theta(c) due to finite Beta effects results in broadening of the region of extremely strong acceleration. It is also found that strong ion acceleration can occur in the nonlinear slow wave in high Beta plasmas. Possibility of unlimited acceleration of ions by quasi-perpendicular magnetosonic fast waves is discussed. Author

N86-22403# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PLASMA PRODUCTION WITH ROTATING ION CYCLOTRON WAVE EXCITED BY NAGOYA TYPE-3 ANTENNAS IN RFC-XX
S. Okamura, K. Adati, T. Aoki, D. R. Baker, H. Fujita, H. R. Garner, K. Hattori, S. Hidekuma, T. Kawamoto, and R. Kumazawa Nov. 1985 37 p refs
(IPPJ-752) Avail: NTIS HC A03/MF A01

A method of plasma production with ion cyclotron wave heating was developed in RFC-XX. Nagoya Type-3 antennas were used for the wave excitation and the gas supply was through a gas box. The effect of the rotation field excitation in plasma production and heating was investigated. In m = -1 rotation mode (rotation in the direction of ion cyclotron motion), the plasma density profile is flat within the gas box bore with the line-integrated density n1 = 3 x 10 to the 13th power/sq cm and the ion temperature T sub i approx. 150 eV. For m = +1 mode, a high density plasma was obtained with a different profile which has a peak at the center. In this mode the line-integrated density is nl = 3 x 10 to the 14th power/sq cm with the peak density n(o) = 7 x 10 to the 13th power/cu cm. M.G.

N86-22404 State Univ. of New York, Stony Brook.
FUSION AND FISSION STUDIES FOR THE SYSTEM S-32 + U-238 Ph.D. Thesis
Richard H. Freifelder 1985 76 p
Avail: Univ. Microfilms Order No. DA8522088

The total fusion cross section was measured at energies from .93 to 1.08 times the s-wave interaction barrier for the system S32 + U238. Measurements were made by detecting coincident fission fragments following full momentum transfer in two position sensitive parallel plate avalanche counters. Fission fragment angular distributions were measured from 90 to 166 degrees in the center of mass for all energies except the lowest where the angular range was 127 to 170 degrees. The experimental total fusion cross section was first compared to a one dimensional barrier penetration model which severely underpredicted the data. Then the data were compared to the predictions of coupled channels calculations where the first 2+ and then higher lying states in U238 were included. The calculations with only the 2+ state were able to predict the trend in the data quite well. The measured angular distribution of fission fragments were compared to the predictions of transition state theory. A model using the scission point as the transition state was discussed and predictions based on this model were presented. Dissert. Abstr.

N86-22405# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PULSED MAGNETOHYDRODYNAMIC GENERATOR WITH A

SUPERCONDUCTING MAGNETIC SYSTEM
V. A. Kirillin, A. Ye. Sheyndlin, E. I. Asinovskiy, V. V. Sychev, and V. B. Zenkevich 8 Nov. 1985 9 p
(AD-A161812; FTD-ID(RS)T-0754-85) Avail: NTIS HC A02/MF A01 CSCL 10/2

An urgent need for creating independent sources of electric power capable of generating a power of tens or hundreds of megawatts in a few milliseconds has now emerged. A pulsed MHD generator, in which the conversion of mechanical energy of explosion products into electrical energy is accomplished, can serve as such a power source. There are published reports on testing of such MHD generators with ordinary magnetic systems. It seemed advisable to study the operation of a pulsed generator with a superconductive magnetic system in the overall plan of research on the creation of magnetohydrodynamic generators. The creation of a pulsed MHD generator with a superconductive magnetic system would make it possible to improve substantially the operational indicators of the installation and to ensure its continuous operation, regardless of the presence of additional power sources for feeding the magnet. The problem of creating an optimum generator and a magnetic system with the maximum acceptable field intensity was not raised in the first stage. The purpose of the work was to investigate the set of questions which arise in the joint use of a pulsed MHD generator and a superconductive magnetic system. GRA

N86-22406# Arizona Univ., Tucson. Dept. of Chemistry.
CHARACTERIZATION OF THE GENERAL ELECTRIC CID-17 AS A DETECTOR FOR PLASMA EMISSION SPECTROMETRY Interim Report
Robert B. Bilhorn and M. B. Denton 25 Nov. 1985 61 p
(Contract N00014-83-K-0268)
(AD-A162415; TR-42) Avail: NTIS HC A04/MF A01 CSCL 20/9

Rapid qualitative and quantitative elemental analysis of complex mixtures by optical emission spectrometry requires sensitive simultaneous multiwavelength detection. Until the present, this has been possible only by employing a number of discrete detectors. Detectors for plasma emission spectroscopy must meet demanding requirements, i.e., high quantum yield over a wide wavelength range, low noise, and a very wide dynamic range. Studies have indicated that the Charge Injection Device CID-11B possesses characteristics which make it an ideal detector for atomic spectroscopy. The newer CID-17, having more detector elements and a device geometry which would suggest an enhanced ultraviolet response, was a logical choice. An array camera system based on this device has been designed, constructed and evaluated. It has been found to meet all the requirements for use as a detector for plasma emission spectrometry and over some wavelength ranges to be far superior to photomultiplier tubes. With almost 100,000 channels, true multiwavelength detection is obtained making a new wealth of information available to the analytical chemist. GRA

N86-22407# Lawrence Livermore National Lab., Calif.
MAGNETIC SYSTEMS FOR FUSION DEVICES
C. D. Henning Feb. 1985 15 p Presented at the 8th International Conference on Structural Mechanics in Reactor Technology, Brussels, Belgium, 19 Aug. 1985
(Contract W-7405-eng-48)
(DE86-000743; UCRL-91577; CONF-850809-82) Avail: NTIS HC A02/MF A01

Mirror experiments have led the way in applying superconductivity to fusion research because of unique requirements for high and steady magnetic fields. The first significant applications were Baseball II at LLNL and IMP at ORNL. More recently, the MFTF-B yin-yang coil was successfully tested and the entire tandem configuration is nearing completion. Tokamak magnets have also enjoyed recent success with the large coil project tests at ORNL, preceded by single coil tests in Japan and Germany. In the USSR, the T-7 tokamak has been operational for many years and the T-15 tokamak is under construction, with the TF coils nearing completion. Also the Tore Supra is being built in France. DOE

N86-22408# Los Alamos National Lab., N. Mex.
COMPUTATION OF ANGLE AVERAGED CROSS SECTIONS IN A DEGENERATE COMPTON SCATTERING MEDIUM
G. H. Nickel, M. Pochkowski, and W. F. Bailey 1985 9 p refs Presented at the 3rd International Conference and Workshop on Radiative Properties of Hot Dense Matter, Williamsburg, Va., 14 Oct. 1985 Prepared in cooperation with Air Force Inst. of Tech., Wright-Patterson AFB, Ohio
(Contract W-7405-eng-36)
(DE86-000806; LA-UR-85-3382; CONF-8510172-1) Avail: NTIS HC A02/MF A01

An accurate yet simple analytic method is developed for calculating Compton scattering cross sections for monoenergetic photons interacting with an isotropic and degenerate distribution of relativistic electrons. DOE

N86-22409# Los Alamos National Lab., N. Mex.
ANALYTICAL APPLICATIONS OF ICP-FTS
L. M. Faires, B. A. Palmer, and P. T. Cunningham 1985 7 p refs Presented at the 28th Oak Ridge National Laboratory Conference on Analytical Chemistry, Knoxville, Tenn., 1 Oct. 1985
(Contract W-7405-eng-36)
(DE86-000819; LA-UR-85-3326; CONF-8510151-8) Avail: NTIS HC A02/MF A01

The Analytical Chemistry Group of the Chemistry Division at Los Alamos National Laboratory has been investigating the analytical utility of the inductively coupled plasma (ICP) Fourier transform spectrometer (FTS) combination. While a new state-of-the-art FTS facility is under construction at Los Alamos, preliminary data have been obtained on the one-meter FTS at the National Solar Observatory at Kitt Peak, Arizona. This paper presents an update of the Los Alamos FTS facility, which is expected to be completed in 1986, and presents data showing the analytical potential of an ICP-FTS system. Some of the potential problems of the multiplex disadvantage are discussed, and the advantages of the high resolution obtainable with the FTS are illustrated. DOE

N86-22410# Oak Ridge National Lab., Tenn.
MIGRATION OF A RADIOACTIVE BERYLLIUM IN THE ISX-B TOKAMAK
A. C. England, D. L. Hillis, and P. H. Edmonds Oct. 1985 20 p
(Contract DE-AC05-84OR-21400)
(DE86-001448; ORNL/TM-9550) Avail: NTIS HC A02/MF A01

One of 12 beryllium tiles on a top rail limiter in the Impurity Study Experiment (ISX-B) tokamak was intentionally made radioactive. The migration of the radioactivity due to melting, ablation, and general excoriation of the radioactive tile was studied. Several hundred milligrams of material from the radioactive tile were spread to the other tiles over the course of the experiment, which consisted of more than 3000 tokamak shots. A small amount of activity was found on the bottom of the tokamak vacuum vessel. The distribution of activity on the other limiter tiles showed a marked radially inward directivity, although all of the tiles received some activity. The possibility that some of the activity was the result of photo- and electro-excitation by runaway electrons cannot be ruled out but probably cannot account for the bulk of the effect. DOE

N86-22411# Oak Ridge National Lab., Tenn.
PLASMA ENGINEERING ANALYSIS OF A SMALL TORSATRON REACTOR
J. T. Lacatski, W. A. Houlberg, and N. A. Uckan Oct. 1985 95 p
(Contract DE-AC05-84OR-21400)
(DE86-001469; ORNL/TM-9533) Avail: NTIS HC A05/MF A01

This study examines the plasma physics and reactor engineering feasibility of a small, medium aspect ratio, high-beta, $l = 2$, D-T torsatron power reactor, based on the magnetic configuration of the Advanced Toroidal Facility, Oak Ridge National Laboratory. Plasma analyses are performed to assess whether confinement in a small, average radius plasma is sufficient to yield an ignited or high-Q driven device. Much of the physics assessment focuses on an evaluation of the radial electric field created by the nonambipolar particle flux. Detailed transport simulations are done with both fixed and self-consistent evolution of the radial electric

field. Basic reactor engineering considerations taken into account are neutron wall loading, maximum magnetic field at the helical coils, coil shield thickness, and tritium breeding blanket-shield thickness. DOE

N86-22412# Texas Univ., Austin. Inst. for Fusion Studies.
ANALYTIC THEORY OF THE NONLINEAR M = 1 TEARING MODE
R. D. Hazeltine, J. D. Meiss, and P. J. Morrison Sep. 1985 24 p (Contract DE-FG05-80ET-53088)
(DE86-001783; DOE/ET-53088/205; IFSR-205) Avail: NTIS HC A02/MF A01

Numerical studies show that the m = 1 tearing mode continues to grow exponentially well into the nonlinear regime, in contrast with the slow, Rutherford, growth of m > 1 modes. We present a single helicity calculation which generalizes that of Rutherford to the case when the constant-psi approximation is invalid. As in that theory, the parallel current becomes an approximate flux function when the island size, W, exceeds the linear tearing layer width. However for the m = 1 mode, W becomes proportional to deltaB, rather than (deltaB)/sup 1/2/ above this critical amplitude. This implies that the convective nonlinearity in Ohm's law, which couples the m = 0 component to the m = 1 component, dominates the resistive diffusion term. The balance between the inductive electric field and this convective nonlinearity results in exponential growth. Assuming the form of the perturbed fields to be like that of the linear mode, we find that the growth occurs at 71% of the linear rate. DOE

N86-22413# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PLASMA PROCESSES IN THE EXCITATION OF HERBIG-HARO OBJECTS
I. Axnaes, N. Brenning, and G. Gahm (Stockholm Observatory, Sweden) Dec. 1984 27 p refs
(TRITA-EPP-84-09; ISSN-0348-7539) Avail: NTIS HC A03/MF A01

The UV excess from highly ionized elements in the high-excitation Herbig-Haro objects is discussed. It is proposed that it can be explained if a sheath is formed in the object, with heating in excess of ordinary shock wave calculations. Such a sheath could be the result of dynamo interaction between a Herbig-Haro cloudlet and a magnetized stellar wind, with a transverse magnetic field of the order of 0.1 m Gauss. Author (ESA)

N86-22414# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Forschungsbereich Energetik.
POPULATION INVERSIONS OF QUANTUM LEVELS IN SPACE AND TIME-DEPENDENT FAST RECOMBINING PLASMAS. THEORY OF THE RECOMBINATION LASER Ph.D. Thesis - Stuttgart Univ.
Willi L. Bohn Jul. 1985 236 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-974)
(DFVLR-FB-85-47; ISSN-0171-1342) Avail: NTIS HC A11/MF A01; DFVLR, Cologne DM 40.50

A theory of ionization and recombination for optically thin and thick plasmas was derived in order to calculate the population densities of excited quantum levels in hydrogen and hydrogen-like ions. Criteria for the generation of population inversions were established within a quasi-static approximation leading to a theory of the recombination laser. A hydrodynamic computer code for one-dimensional plasma flows which describes the transient properties of population inversions was developed. Laser transitions in a plasma nozzle flow, in the plasma expansion into vacuum, and in the plasma expansion in the presence of a background gas are described in good agreement with available experimental data. Inversions leading to XUV-laser transitions are emphasized. Author (ESA)

N86-22278# Joint Publications Research Service, Arlington, Va.
NONEQUILIBRIUM EFFECTS AND STRUCTURE OF X-RAY LINES IN TOKAMAK PLASMA Abstract Only
V. G. Gontis and V. S. Lisitsa *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 25-26 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 438-492 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22290# Joint Publications Research Service, Arlington, Va.
SLOW COMBUSTION OF LASER PLASMA AND OPTICAL CHARGES Thesis - USSR Academy of Sciences, 1984 Abstract Only
Vadim Borisovich Fedorov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 39-40 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22291# Joint Publications Research Service, Arlington, Va.
SPECTROSCOPY OF LABORATORY AND SPACE PLASMA WITH OSCILLATING ELECTRICAL FIELDS Thesis - USSR Academy of Sciences, 1984 Abstract Only
Evgeniy Aleksandrovich Oks *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 40 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22292# Joint Publications Research Service, Arlington, Va.
EQUILIBRIUM STATES OF CHARGED ELECTRON BEAMS AND SPACE CHARGE COMPENSATION PROCESSES Thesis - USSR Academy of Sciences, 1984 Abstract Only
Vladimir Alekseyevich Malafayev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 44 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22293# Joint Publications Research Service, Arlington, Va.
ESTIMATES OF PARAMETERS OF HOT ELECTRONS DURING BEAM HEATING OF PLASMA IN A MAGNETIC FIELD Abstract Only
B. N. Breyzman and V. I. Yerofeev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 42 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 387-393 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22294# Joint Publications Research Service, Arlington, Va.
TWO-DIMENSIONAL KINETIC MODEL OF HYDROGEN MACRO-PARTICLE EVAPORATION IN A TOKAMAK Abstract Only
B. V. Kuteyev, A. P. Umov, and L. D. Tsendin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 43 Transl. into ENGLISH from Fiziki Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 409-416 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22295# Joint Publications Research Service, Arlington, Va.
RELATIVISTIC EFFECTS DURING COMPTON INTERACTION OF STRONG ELECTROMAGNETIC RADIATION AND OPTICALLY THIN LAYER OF COLD PLASMA Abstract Only
Yu. I. Lysikov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 44 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 497-499 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22296# Joint Publications Research Service, Arlington, Va.
PLASMA FLOWS IN DIVERTOR REGIONS OF VINT-20 SINGLE-PASS TORSATRON Abstract Only
V. K. Bocharov, Ye. D. Volkov, G. G. Lesnyakov, and V. B. Yuferov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 44 Transl. into ENGLISH from Fizika Plazmy (Moscow, USSR), v. 11, no. 4, Apr. 1985 p 500-504 (For primary

document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22297# Joint Publications Research Service, Arlington, Va.
COLLISION AND RADIATION PROCESSES IN LOW-TEMPERATURE PLASMA INVOLVING HIGHLY EXCITED ATOMIC AND MOLECULAR STATES Thesis - USSR Academy of Sciences, 1984 Abstract Only
Vladimir Sergeyeviy Lebedev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 46 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22298# Joint Publications Research Service, Arlington, Va.
PLASMA MECHANISM UNDERLYING HIGH PRESSURE GAS BREAKDOWN Thesis - USSR Academy of Sciences, 1984 Abstract Only
Aleksandr Petrovich Broytman *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 47 Transl. into ENGLISH from Russian Thesis (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-22415 Central Electricity Generating Board, London (England). Translation Section.
USING THE NUCLEAR GAMMA RESONANCE METHOD TO STUDY RADIATION DEFECTS IN FERRITES
Yu. F. Babikov, V. M. Maikin, I. I. Marchik, S. V. Sinitsyn, A. N. Spirin, I. V. Starostenko, and M. N. Uspenskii 6 Nov. 1985 16 p refs Transl. from Izvestia Academy of Sciences Kaz SSR Physico-Mathematical Series (USSR), no. 8, 1982 p 65-72
(BLL-CE-Trans-8220-(9022.090)) Avail: British Library Lending Div., Boston Spa, Engl.

The nuclear gamma resonance method was used to investigate the effect of electron irradiation on the properties of yttrium-gallium garnets. The possibility of using this method to study radiation defects not only in ferrimagnetic materials, but also in other compounds, metals and alloys is illustrated. Author

N86-22416*# National Aeronautics and Space Administration, Washington, D.C.
KNbO3 SINGLE CRYSTAL GROWTH BY THE RADIO FREQUENCY HEATING CZOCHRALSKI METHOD
Wenshan Wang, Qun Zou, and Zhaohua Geng Nov. 1985 14 p refs Transl. into ENGLISH from Guisuanyan Xuebao (China), v. 10, no. 1, 1982 p 79-85 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Nanjing Univ., China
(NASA-TM-77944; NAS 1.15:77944) Avail: NTIS HC A02/MF A01 CSCL 20L

A radio frequency heating Czochralski technique to obtain single crystal KNbO3 is first presented. The technological parameters of KNbO3 crystal growth by the Czochralski technique and its pulling conditions were studied in detail. The experiments on second harmonic generation using 1.06 micrometer Nd:YAG laser in KNbO3 have been conducted. The second harmonic efficiency for upconversion of KNbO3 is found to be as high as that of NaBa2Nb5O15. An automatic scanning measurement for the optical homogeneity of KNbO crystal is also described. KNbO3 is revealed to be a potentially useful nonlinear material for optical device applications. Author

N86-22417*# National Aeronautics and Space Administration, Washington, D.C.
A STUDY ON INCLUSION FORMATION MECHANISM IN ALPHA-LIIO SUB 3 CRYSTALS
Wan-Chun Chen, Shou-Li Yan, Shou-Quan Jia, and Shu-Yong Du Dec. 1985 16 p refs Transl. into ENGLISH from Guisuanyan Xuebao (Beijing, China), v. 10, no. 1, Mar. 1982 p 79-85 Transl. by SCITRAN, Inc., Santa Barbara, Calif. Original doc. was prep. by Inst. of Physics, Academia Sinica
(NASA-TM-77943; NAS 1.15:77943) Avail: NTIS HC A02/MF A01 CSCL 20L

The spatial distribution of inclusions in alpha-LiIO3 crystals by means of an argon laser beam scanning technique is studied. The effects of crystal dimensions and solution fluid flow on the inclusion formation in the alpha-LiIO3 crystals were observed. It was further shown that the fluid flow plays an important role in the formation of inclusions. The results obtained were further applied and verified by growing a perfect alpha-LiIO3 single crystal. An experimental foundation for further theoretical studies on the causes of inclusions may be provided. Author

N86-22418*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THIN-FILM CHEMICAL SENSORS BASED ON ELECTRON TUNNELING Final Report
S. K. Khanna, J. Lambe, H. G. LeDuc, and A. P. Thakoor 15 Nov. 1985 36 p refs
(Contract DE-AI01-82ER-13007)
(NASA-CR-176662; JPL-PUB-85-85; DOE/ER-13001/1; NAS 1.26:176662) Avail: NTIS HC A03/MF A01 CSCL 20L

The physical mechanisms underlying a novel chemical sensor based on electron tunneling in metal-insulator-metal (MIM) tunnel junctions were studied. Chemical sensors based on electron tunneling were shown to be sensitive to a variety of substances that include iodine, mercury, bismuth, ethylenedibromide, and ethylenedichloride. A sensitivity of 13 parts per billion of iodine dissolved in hexane was demonstrated. The physical mechanisms involved in the chemical sensitivity of these devices were determined to be the chemical alteration of the surface electronic structure of the top metal electrode in the MIM structure. In addition, electroreflectance spectroscopy (ERS) was studied as a complementary surface-sensitive technique. ERS was shown to be sensitive to both iodine and mercury. Electrolyte electroreflectance and solid-state MIM electroreflectance revealed qualitatively the same chemical response. A modified thin-film structure was also studied in which a chemically active layer was introduced at the top Metal-Insulator interface of the MIM devices. Cobalt phthalocyanine was used for the chemically active layer in this study. Devices modified in this way were shown to be sensitive to iodine and nitrogen dioxide. The chemical sensitivity of the modified structure was due to conductance changes in the active layer. Author

N86-22419# California Univ., Santa Barbara. Dept. of Physics.
SQUEEZABLE TUNNEL JUNCTIONS
P. K. Hansma Oct. 1985 17 p
(Contract N00014-78-C-0011)
(AD-A161537; TR-20) Avail: NTIS HC A02/MF A01 CSCL 20/12

Squeezable tunnel junctions set the current state of the art for resistance stability of mechanically adjustable tunneling structures at Delta R/R approx 0.1%. This is sufficient for spectroscopies as subtle as phonon spectroscopy, but it is marginal and cannot be maintained to high enough bias voltage to permit molecular vibrational spectroscopy at present. Squeezable junctions have been used for characterizing bulk samples and for C-V analysis on semiconductors. GRA

N86-22420# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
A MEASUREMENT OF INTRINSIC SIO2 FILM STRESS RESULTING FROM LOW TEMPERATURE THERMAL OXIDATION OF Si Interim Technical Report
E. Kobeda and E. A. Irene 1 Oct. 1985 15 p
(Contract N00014-83-K-0571)
(AD-A161620; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

Over the past several years there have been a number of

studies that have reported an intrinsic SiO2 film stress resulting from the thermal oxidation of Si at low oxidation temperatures. The intrinsic stress has been considered to be influential in Si oxidation kinetics both at the Si-SiO2 interface and by altering the diffusion of oxidant. Various stress measurements have been reported using light in single beam and double beam reflection experiments, and using the automatic Bragg angle camera (ABAC) technique. Laser techniques are not well described in the literature, often without calibration standards, diagrams and detailed procedures. A double beam technique, with calibration standards and the experimental results of one study using the technique to measure SiO2 stress on Si at room temperature is reported. This parallel beam reflection technique has been developed in the laboratory for measuring intrinsic residual stress for Si wafers thermally oxidized at temperatures of 600 to 1150 C. Low temperature thermal oxidations resulted in compressive intrinsic SiO2 stresses greater than 4,000,000,000 dyn/sq cm. GRA

N86-22421# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
SILICON OXIDATION STUDIES. SILICON ORIENTATION EFFECTS ON THERMAL OXIDATION Interim Technical Report
Eugene A. Irene, H. Z. Massoud, and E. Tierney 1 Oct. 1985 19 p Prepared in cooperation with Duke Univ., Durham, N.C., and IBM Watson Research Center, Yorktown Heights, N.Y.
(Contract N00014-83-K-0571)
(AD-A161633; TR-3) Avail: NTIS HC A02/MF A01 CSCL 20/12

The initial stage of the thermal oxidation of various crystallographic orientations of silicon reveals a complex rate behavior. This behavior is not understood within the conventional linear - parabolic model. A recently revised model which explicitly contains the areal density of Si atoms and mechanical stress effects is shown to provide both a qualitative and somewhat quantitative explanation of the complex substrate orientation effects. The purpose of this study is to analyze the crossover effect in terms of a recently proposed viscous flow model for Si oxidation. This model utilizes the notion of mechanical stress and viscous relaxation in SiO2 which occur as a result of the oxidation process on a Si substrate in addition to the other assumptions in the L-P model such as a steady state between the interface reaction and the transport of oxidant through the oxide. It is reported herein that the new viscous flow model provides a reasonable qualitative explanation for the crossover effect and in some instances a quantitative correlation of the effect. GRA

N86-22422# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
A MEASUREMENT OF THE EFFECT OF INTRINSIC FILM STRESS ON THE OVERALL RATE OF THERMAL OXIDATION OF SILICON Interim Technical Report
J. K. Srivastava and E. A. Irene 1 Oct. 1985 9 p
(Contract N00014-83-K-0571)
(AD-A161634; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/12

Recently, in our laboratory more extensive intrinsic stress measurements have been made and these measurements will be reported separately. So while the existence of a compressive intrinsic SiO2 film stress has been experimentally verified, the experimental verification of the effects of the stress on oxidation kinetics remains a matter of speculation within the various models. Along with the development of an intrinsic film stress due to the molar volume change during the oxidation of Si, a SiO2 film density increase occurs and has been measured. We consider the intrinsic stress and density increases to have a common origin in the nature of the Si oxidation process on a single crystal Si surface. The present communication provides a rather direct experimental measurement of the effect of the compressive intrinsic film stress and/or oxide density on the Si oxidation kinetics. All the Si wafers used were lightly P doped n-type (100) oriented commercially available high quality single crystal Si slices. GRA

N86-22423# California Univ., San Diego. Inst. for Pure and Applied Physical Sciences.
A STUDY OF SURFACE PROPERTIES OF SUPERCONDUCTING MATERIALS FOR HIGH POWER MICROWAVE APPLICATIONS Final Technical Report, 1 Aug. 1982 - 31 Aug. 1985
Harry Suhl and Wayne Vernon 31 Oct. 1985 10 p
(Contract N00014-82-K-0578)
(AD-A161740) Avail: NTIS HC A02/MF A01 CSCL 20/3

We have investigated electric and magnetic critical field levels for Nb and Nb sub 3 Sn superconductors. Since the maximum power levels for RF-Superconducting cavities seem to be limited by maximum magnetic field capability, most of the work involved studies of the time dependence of flux penetration into Nb sub 3 Sn samples where maximum field limits are unknown. We find that the lower critical field (Hc sub 1) of Nb sub 3 Sn is about 600 gauss at low temperature and 2MHz frequency of applied field, but flux penetration occurs at very low level so that considerably higher field values will not lead to large power loss. Additional interesting effects are associated with Nb sub 3 Sn on Nb substrates which may also lead to increased peak power capability. GRA

N86-22424# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
MODELS FOR THE OXIDATION OF SILICON Interim Technical Report
E. A. Lewis and E. A. Irene 1 Oct. 1985 29 p
(Contract N00014-83-K-0571)
(AD-A161751; TR-1) Avail: NTIS HC A03/MF A01 CSCL 20/12

Many adaptations to the linear parabolic model for silicon oxidation have been proposed. For the purpose of process engineering, curve fitting procedures which are sometimes devoid of physical content but numerically precise are employed. However, a truely unified physical model which is in quantitative accord with all known facts is still lacking. In this review, we will discuss the facts and newer models. GRA

N86-22425# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.
FLUORESCENCE PROPERTIES OF DANSYL GROUPS COVALENTLY BONDED TO THE SURFACE OF OXIDATIVELY FUNCTIONALIZED LOW-DENSITY POLYETHYLENE FILM
Stephen R. Holmes-Farley and George M. Whitesides Dec. 1985 57 p
(Contract N00014-83-K-0142)
(AD-A162435; TR-85-2) Avail: NTIS HC A04/MF A01 CSCL 07/4

Brief oxidation of low-density polyethylene film with chromic acid in aqueous sulfuric acid introduced carboxylic acid and ketone and/or aldehyde groups onto the surface of the film. The carboxylic acid moieties can be used to attach more complex functionality to the polymer surface. We are developing this surface-functionalized polyethylene (named polyethylene carboxylic acid, PE-CO2H, to emphasize the functional group that dominates its surface properties) as a substrate with which to study problems in organic surface chemistry--especially wetting, polymer surface reconstruction, and adhesion--using physical-organic techniques. This document describes the preparation, characterization, and fluorescence properties of derivatives of PE-CO2H in which the Dansyl (5-dimethylaminonaphthalene-1-sulfonyl) group has been covalently attached by amide links to the surface carbonyl moieties. GRA

N86-22426# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
THEORETICAL INVESTIGATIONS OF THE CVD (CHEMICAL VAPOR DEPOSITION) OF SILICON FROM SILANE Final Report, 1 Sep. 1982 - 31 Aug. 1985
Lionel M. Raff and Donald L. Thompson 31 Aug. 1985 20 p
(Grant AF-AFOSR-0311-82)
(AD-A162548; AFOSR-85-1032TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The results of a program of theoretical research to determine the relative importance and dynamics of various elementary processes occurring in the chemical vapor deposition (CVD) of silicon from silane are reported. The processes studied include the gas-phase unimolecular dissociation of SiH4, Ch4, and SiH2, the homogeneous three-body recombination of Si atoms, surface adsorption and diffusion of Si atoms on Si(100) and Si(111) surfaces, and the recombination and desorption of H2 on silicon surfaces. In addition, several studies involving the reaction dynamics of van der Waals molecules are described. We also report the development of a quantum mechanical method for computing the results of elastic and inelastic atomic scattering from surfaces. Author (GRA)

N86-22427# Washington Univ., St. Louis, Mo. Dept. of Electrical Engineering.
SEMICONDUCTOR MILLIMETER WAVELENGTH ELECTRONICS Final Report, Sep. 1979 - Dec. 1983
F. J. Rosenbaum Dec. 1985 14 p
(Contract N00014-79-C-0840; RR0-2102)
(AD-A162566; Rept-85-1-ONR) Avail: NTIS HC A02/MF A01 CSCL 20/12

This final report summarizes the results of research carried out on topics in millimeter wavelength semiconductor electronics under an ONR Selected Research Opportunity program. Study areas included III-V compound semiconductor growth and characterization, microwave and millimeter wave device modeling, fabrication and testing, and the development of new device concepts. A new millimeter wave mixer and detector, the Gap diode was invented. Topics reported on include ballistic transport, Zener oscillations, impurities in GaAs, electron velocity-electric field calculation and measurements, etc., calculations. GRA

N86-22428# Chicago Univ., Ill.
TEMPERATURE DEPENDENCE OF THE WORK FUNCTION OF Cu LAYERS ON A W(110) PLANE
Robert Gomer Nov. 1985 19 p
(Contract N00014-77-C-0018)
(AD-A162573; AD-E900528; Rept-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

In the course of following the thermal desorption of CO adsorbed on Cu layers on W(110), i.e., W(110)/Cun/CO by work function changes a substantial temperature coefficient of work function was noted for the substrates and investigated in some detail. Temperature coefficients of work function for Cu layers in the range 0 < or = 6 where n is the number of monolayers were measured from 90 to 500 K by a Kelvin probe method. d phi/d sub T is negative at all coverages and has a strong maximum of -.00015 ev/K at n = 1 at 90 K. A qualitative discussion of these findings is given. The design and operating characteristics of the Kelvin probe are also described. GRA

N86-22429# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
DIFFUSION AND DEFECT CHARACTERIZATION STUDIES OF MERCURY CADMIUM TELLURIDE Semiannual Progress Report, 1 Feb. - 31 Jul. 1985
D. A. Stevenson 31 Jul. 1985 5 p
(Contract N00014-84-K-0423; ARPA Order 5019)
(AD-A162644) Avail: NTIS HC A02/MF A01 CSCL 20/12

During the last 6 months, progress has been made on the two major areas of this program: diffusion studies in mercury cadmium telluride (MCT), and growth studies. In the former area, self diffusion measurements have been made, with emphasis on the comparison of experiments using a pure Hg reservoir and experiments using a liquid + solid reservoir. In the growth studies, major emphasis has been on the analysis and theory of the isothermal vapor phase epitaxial growth process (IVPE). GRA

N86-22430# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
DEVELOPMENT OF A SYSTEM TO PRODUCE SEMICONDUCTOR INSULATOR MULTI-LAYER STRUCTURES Quarterly Report, 1 Mar. - 31 May 1985
David J. Dumin Jun. 1985 4 p
(Contract N00014-84-K-2015)
(AD-A162750; QR-3) Avail: NTIS HC A02/MF A01 CSCL 20/12

The construction of the epitaxial reactor to be used to grow the multilayer films and to begin to grow multiple silicon-insulator films was completed. The system was pressure tested and all lines hold pressure over night. During preliminary runs to coat the silicon carbide susceptor with silicon, it was noticed that the parts of the equipment surrounding the reaction chamber become quite hot during operation of the reactor. There are several causes for this over heating. The hydrogen flow is presently limited by the hydrogen regulator being used in the system. A higher pressure regulator is needed to increase the hydrogen flow and increase the cooling that higher hydrogen flow will provide. The susceptor presently being used is 1 in. thick. It will be necessary to use a thinner susceptor to lower the thermal mass in the system. It may be necessary to water cool the reaction chamber. The first films grown in the system were silicon-on-sapphire films. The SOS films were used to determine the quality of the epitaxial system. GRA

N86-22431# Pennsylvania State Univ., University Park. Materials Research Lab.
INVESTIGATIONS INTO THE ORIGINS OF THE PHYSICAL STRUCTURE OF THIN FILMS Annual Report, 1 Jul. 1984 - 30 Jun. 1985
Russell Messier 25 Oct. 1985 42 p
(Grant AF-AFOSR-0149-84)
(AD-A162772; AFOSR-85-1105TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The random ballistic aggregation of atoms onto a surface under low adatom mobility conditions leads to clustering and evolution of growth cones from these random clusters. The connections between these basic physical processes and the resulting wide variety of thin film morphologies (both top surface and cross-section) are being made in an attempt to quantify morphology, and ultimately properties. The research can be divided into four research thrust areas: (1) controlled film preparation; (2) morphological characterization of the resulting films; (3) image enhancement/quantification of micrographs of morphology; and (4) conceptual and computer modeling of the morphology. Progress in each of these areas. GRA

N86-22432# Wisconsin Univ., Madison. Dept. of Chemistry.
EXCITED-STATE PROPERTIES OF SEMICONDUCTOR ELECTRODES AND THEIR APPLICATION TO OPTICAL ENERGY CONVERSION Final Report, 1 Jul. 1978 - 30 Jun. 1985
Arthur B. Ellis 26 Dec. 1985 6 p
(Contract N00014-78-C-0633)
(AD-A162774) Avail: NTIS HC A02/MF A01 CSCL 20/12

The luminescent properties of a variety of II-VI and III-V semiconductor electrodes have been investigated. The excited-state properties of semiconductor electrodes and their application to optical energy conversion is also discussed. GRA

N86-22433# Los Alamos National Lab., N. Mex.
SUPERCONDUCTIVITY IN THE ACTINIDES
J. L. Smith and A. C. Lawson 1985 6 p Presented at ACTINIDES 85, Aix-en-Provence, France, 1 Sep. 1985
(Contract W-7405-eng-36)
(DE86-000786; LA-UR-85-3143; CONF-8509147-9) Avail: NTIS HC A02/MF A01

The trends in the occurrence of superconductivity in actinide materials are discussed. Most of them seem to show simple transition metal behavior. However, the superconductivity of americium proves that the f electrons are localized in that element and that actinides is the correct name for this row of elements. Recently the superconductivity of UBe13 and UPt3 has been shown to be extremely unusual, and these compounds fall in the new class of compounds now known as heavy fermion materials. DOE

N86-22256# Joint Publications Research Service, Arlington, Va.
MODULATION OF IR LASERS BY SEMICONDUCTING PLASMA Abstract Only
L. I. Berezhinskiy and A. I. Liptuga *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 2 Transl. into ENGLISH from Kvantovaya Elektronika (Kiev, USSR), v. 27, Oct. 1984 p 50-54 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22299# Joint Publications Research Service, Arlington, Va.
NONLINEAR PROPERTIES OF SUPERCONDUCTING POINT CONTACTS AND PROSPECTS FOR USE IN QUANTUM ELECTRONICS Abstract Only
M. V. Danilenko, V. E. Derkach, E. M. Belenov, V. I. Romanenko, and A. V. Uskov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-003) 5 Feb. 1986 p 48 Transl. into ENGLISH from Kvantovaya Elektronika (Kiev, USSR), v. 27, Oct. 1983 p 3-37 (For primary document see N86-22254 12-70)
Avail: NTIS HC A04

N86-22494# Danish Space Research Inst., Lyngby.
MEASUREMENTS OF INTRINSIC WIDTH AND MOSAICITY OF TEST CRYSTALS WITH A NOVEL FOUR-CRYSTAL X-RAY SPECTROMETER
F. E. Christensen, H. W. Schnopper, E. H. Silver (LLNL, Berkeley, Berkeley, Calif.), and N. J. Westergaard *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 213-220 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22504# Mullard Space Science Lab., Dorking (England).
X-RAY APPLICATIONS OF DEEP-DEPLETION CCDS
D. M. Walton, J. L. Culhane, R. A. Stern (Lockheed Aircraft Corp., Palo Alto, Calif.), and R. C. Catura *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 291-295 refs Sponsored by UK Science and Engineering Research Council and Lockheed Independent Research Program (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22505# Leicester Univ. (England).
X-RAY IMAGING SPECTROSCOPY WITH CCDS
A. Wells, D. Lumb, and R. Willingale *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 297-302 refs Sponsored by UK Science and Engineering Research Council and Lockheed Independent Research Program (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-22434# RAND Corp., Santa Monica, Calif.
CONCEPTS, PROBLEMS AND OPPORTUNITIES FOR USE OF ANNIHILATION ENERGY: AN ANNOTATED BRIEFING ON NEAR-TERM RDT/E TO ASSESS FEASIBILITY
B. W. Augenstein Jun. 1985 70 p
(Contract F49620-82-0018)
(AD-A161719; RAND/N-2302-AF/RC) Avail: NTIS HC A04/MF A01 CSCL 20/8

This note discussed several issues inherent in exploiting the energy released when matter and antimatter annihilate. It reviews some of the fundamental difficulties in produding Antimatter and means for storing it. If these difficulties have satisfactory solutions, a number of applications for antimatter are likely to emerge. The note emphasizes the fundamental importance of the very large classes of interesting research efforts underlying applications goals, and the anticipated rapid growth of science needs for antimatter at low energies. The authors suggests a near-term program to resovle the current uncertainities of suitable production and storage technologies, so that basic feasiblity of application of antimatter can be decided, and decisions on whether to undertake expanded production with appropriate storage can be objectively made. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N86-22435# Committee on Science and Technology (U. S. House).
NASA'S LONG RANGE PLANS
Washington GPO 1986 224 p Hearings before the Subcommittee on Space Science and Applications of the Committee on Science and Technology, 99th Congress, 1st Session, no. 57, 17, 19, 1985
(GPO-55-035) Avail: Subcommittee on Space Science and Applications

The long range planning schedule for NASA programs is reviewed. Objectives are summarized for programs in space flight, space science and applications, space stations, space technology, and Space tracking and Data Systems. B.G.

N86-22436# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF FOREIGN SOURCE DEPENDENCE FOR CRITICAL MICROCIRCUITS OF USAF AVIONICS COMPONENTS M.S. Thesis
Thomas L. Bass and Robert W. Norman, Jr. Sep. 1985 139 p (AD-A161311; AFIT/LS/GLM/85S-58) Avail: NTIS HC A07/MF A01 CSCL 01/4

An attempt is made to investigate the Air Force's dependency on foreign sources for the procurement of microcircuits used in avionics systems. The research was divided into two segments: a particular sample of microcircuits was analyzed to determine which microcircuits were procured directly from a foreign source and then determine the criticality of those foreign manufactured microcircuits; the second segment consisted of interviews with government officials, microcircuit suppliers/vendors, and manufacturing representatives to obtain their opinions as to the extent of U.S. dependency on foreign sources for the manufacture of ceramic dual-in-line microcircuits. It was discovered that the current method used by the Defense Electronics Supply Center and AFLC's Cataloging and Standardizations Center to identify foreign manufactured micorcircuits greatly understates this country's dependency on foreign sources for microcircuits. It was concluded that more effort should be expended by the Department of Defense to determine the actual capability of onshore manufacturers and to attempt to get manufacturers to move back onshore. GRA

N86-22437# Science Applications International Corp., McLean, Va. Behavioral Sciences Research Center.
ASPECTS OF COGNITIVE COMPLEXITY THEORY AND RESEARCH AS APPLIED TO A MANAGERIAL DECISION MAKING SIMULATION
Siegfried Streufert and Robert W. Swezey Sep. 1985 133 p
(Contract MDA903-79-C-0699; DA Proj. 2Q1-62722-A-791)

(AD-A161376; SAI-82-03-178; ARI-RN-85-96) Avail: NTIS HC A07/MF A01 CSCL 05/1

This research note is a post-1977 review of the literature in the areas of theory, research, and measurement of cognitive complexity. It updates the previous major review effort of Streufert and Streufert (1978). Additional discussion is devoted to the approaches selected for measuring cognitive complexity with a mini-computer based Management Assessment and Training Simulation System. Author (GRA)

N86-22438# Naval Postgraduate School, Monterey, Calif.
AN ORGANIZATIONAL DEVELOPMENT HANDBOOK M.S. Thesis
Deborah A. Gallo Sep. 1985 123 p
(AD-A161414) Avail: NTIS HC A06/MF A01 CSCL 05/1

Richard Beckhard defined Organizational Development as a planned effort, organization-wide, and managed from the top to increase organization effectiveness and health through planned interventions in the organization's processes using behavioral-science knowledge. This thesis is a compendium of some of theories, models, and tools of Organizational Development (OD) and serves as a guide for the author. It represents the current state in the author's quest to apply these theories to the Navy's environment and operational commitments. This OD Handbook starts with a definition and purpose of OD. A list of consultant competencies and behaviors are then generated along with marketing techniques and consultant ethics. Diagnostic models to assist in analysis of the organization are presented. Consultant Tools are discussed in terms of transition workshop, hints on data gathering and feedback, strategic planning packages, guidance on contracting, and the stages of group development. GRA

N86-22439# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
INITIAL AND QUALIFICATION OPERATIONAL TEST AND EVALUATION IN THE ACQUISITION OF NON-MAJOR COMMUNICATION SYSTEMS M.S. Thesis
Lorraine Y. Roemish Sep. 1985 93 p
(AD-A161729; AD-E301835; AFIT/GLM/LSM/85S-69) Avail: NTIS HC A05/MF A01 CSCL 17/2

The use of operational test and evaluation (OT&E) results in the acquisition decision-making process has been increasingly emphasized in the past years and has gained even more prominence with the establishment of the Operational Test and Evaluation Office at the Department of Defense. Special emphasis has been placed on the use of OT&E in the production decision. Initial Operational Test and Evaluation (IOT&E) and Qualification Operational Test and Evaluation (QOT&E) are the types of test and evaluation that are normally conducted on systems prior to the first major production decision in the acquisition process. While IOT&E usually evaluates new systems and QOT&E usually evaluates off-the-shelf systems, they both provide program decision makers with valid estimates of operational effectiveness and operational suitability upon which they can base their decisions. This thesis has looked at how IOT&E and QOT&E reports written by the 1815th Tests and Evaluation Squadron (AFCC) are used in the acquisition of non-major communication systems. The results of this research reveal that the OT&E conducted by the 1815th is usually QOT&E performed on off-the-shelf systems. Since these systems involve very little technical risk the OT&E are not usually the primary factor in production decisions. OT&E results are most useful in pointing out deficiencies requiring correction prior to fielding such systems. GRA

N86-22440# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
RISK AND THE RIGHT MODEL
John A. Long 1985 11 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161757) Avail: NTIS HC A02/MF A01 CSCL 05/1

All aspects of life in the world are subject to risk and uncertainty. Risk and uncertainty are key characteristics of any long range planning and cost conditions of any long range planning and cost estimation. Few, if any, decisions are made under conditions of certainty and without risk. Due to the complexities involved, analysts and decision makers must specifically and explicitly address this risk and uncertainty in performing their assigned tasks. Although the terms risk and uncertainty are often used interchangeably, they are not the same. Risk is the probability that a planned event will not be attained within constraints (cost, schedule, performance) by following a specified course of action. It is the task of analysts to try to reduce uncertainty to risk and then to meaningfully convey the risk to decision makers. This document defines risk analysis as a procedure for analyzing how randomness affects the total cost. GRA

N86-22441# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A METHODOLOGY FOR APPLYING BAR CODE TECHNOLOGY TO AIRCRAFT MAINTENANCE UNIT SUPPORT SECTIONS M.S. Thesis
Paul Valovcin Sep. 1985 97 p
(AD-A161783; AFIT/GLM/LSM/85S-79) Avail: NTIS HC A05/MF A01 CSCL 09/2

This study developed a methodology that decision makers can use as an aid to determine if bar code technology should be applied in Aircraft Maintenance Unit (AMU) Support Sections. The literature review revealed that the Logistics Applications of Automated Marking and Reading Symbols (LOGMARS) steering group recommended that bar code technology applications be aggressively pursued across the logistics spectrum due to the success of the LOGMARS test program. Since AMU support sections perform many functions similar to those that have already benefited form this technology as it applies to an AMU support sections. Worksheets were designed to help collect and analyze the necessary cost/benefit information so that decision makers will be able to properly assess the expected cost and benefits for a particular support section. GRA

N86-22442# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
APPLICATIONS OF COMPUTERS AS AN AID TO DECISION-MAKING IN AIR FORCE SYSTEM PROGRAM OFFICES M.S. Thesis
Roger D. Koble Sep. 1985 171 p
(AD-A161784; AFIT/GSM/LS/85S-20) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis investigated the most advantageous areas for applying decision support systems to Air Force Systems Command program and project managers in System program Offices. Data was gathered by surveying a stratified sample of program and project managers. In this research, groups of program and project managers. In this research, groups of program and project managers where identified that may required different types of support based upon the influence the groups have in the decision process in the areas of cost and budget, schedule, technical performance, logistics, and administration. The following three rank groups were choosen as the basis for evaluation of different DSS needs: Lieutenants, Captains, and Majors through Colonels. Findings indicated that all three rank groups need similar support from any DSS development. An additional result of this empirical research was a prioritized list of program management techniques for DSS development and implementation. GRA

N86-22443# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT, FLIGHT DYNAMICS LABORATORY PLANS FOR FISCAL YEAR 1987 Final Report, Aug. 1984 - Jul. 1985
Jul. 1985 75 p Supersedes AFWAL-TR-84-3000, AD-A149648 (AD-A162792; AFWAL-TR-85-3000; AFWAL-TR-84-3000) Avail: NTIS HC A04/MF A01 CSCL 01/3

The document presents an overview of the Laboratory Technology Planning Objectives of the Flight Dynamics Laboratory omitting specific funding and timing information of an Official Use

Only nature. Technology planning objectives are described for Structures and Dynamics, Vehicle Equipment, Flight Control, Aeromechanics, and Technology Assessment. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-22444* National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES (SUPPLEMENT 28)
Jan. 1986 478 p
(NASA-SP-7039(28); NAS 1.21:7039(28)) Avail: NTIS HC A21 CSCL 05B

A subject index is provided for over 4800 patents and patent applications for the period May 1969 through December 1985. Additional indexes list personal authors, corporate authors, contract numbers, NASA case numbers, U.S. patent class numbers, U.S. Patent numbers, and NASA accession numbers. Author

N86-22445*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SCIENTIFIC AND TECHNICAL INFORMATION OUTPUT OF THE LANGLEY RESEARCH CENTER FOR CALENDAR YEAR 1985
Jan. 1986 277 p
(NASA-TM-87655; NAS 1.15:87655) Avail: NTIS HC A13/MF A01 CSCL 05B

A compilation of the scientific and technical information that the Langley Research Center has produced during the calendar year 1985 is presented. Included are citations for Formal Reports, Quick-Release Technical Memorandums, Contractor Reports, Journal Articles and Other Publications, Meeting Presentations, Technical Talks, Computer Programs, Tech Briefs, and Patents. Author

N86-22446# Massachusetts Inst. of Tech., Lexington.
UNCLASSIFIED PUBLICATIONS OF LINCOLN LABORATORY, VOLUME 10 Report Bibliography, 15 Dec. 1983 - 31 Dec. 1984
31 Dec. 1984 79 p
(Contract F19628-85-C-0002)
(AD-A161752; ESD-TR-84-329) Avail: NTIS HC A05/MF A01 CSCL 09/1

Volume 10 of Unclassified Publications of Lincoln Laboratory lists reports published from 15 December 1983 to 31 December 1984, as well as updated information on earlier publications. Included are quarterly technical reports, semiannual technical summary reports, miscellaneous progress reports, technical reports, journal articles; meeting speeches; and author and subject indexes. Examples of titles listed. Angles-Only, Ground-Based, Initial Orbit Determination, Expected Energy Method for Electro-Optical SNR Calculations, Performance of Bayes-Optimal Angle-of-Arrival Estimators, Electronic Properties of Grain Boundaries in GaAs: A Study of Oriented Bicrystals Prepared by Epitaxial Lateral Overgrowth, The Lincoln Low-Rate Vocoder: A 1200/2400 bps LPC-10 Voice Terminal. Items are listed by the Lincoln Laboratory number, the title, the authors, the date published and the DTIC number. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N86-22447# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
LOW COST MANAGEMENT OF REPLICATED DATA Ph.D. Thesis
Thomas A. Joseph Jan. 1986 93 p
(Contract MDA903-85-C-0124; ARPA Order 5378)
(AD-A162771; TR-85-712) Avail: NTIS HC A05/MF A01 CSCL 09/2

A method for managing replicated data that eliminates latency is developed. This work can be viewed as a generalization of the results to systems with arbitrary types of data, with operations more powerful than reads and writes, and with other kinds of synchronization mechanisms than two-phase locking. Further, it is shown that it is possible to transmit the information required to maintain consistency using messages that would be sent between sites even if data were not replicated. In other words, the replication method requires no additional messages. The implication is that of the costs of replication described above, the only costs that need be incurred are the unavoidable costs of additional storage and local processing. A model for distributed systems is presented. Methods for managing replicated data are also presented. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N86-22448# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS FOR LANDSAT COMMERCIALIZATION
Washington GPO 1985 6 p Report to accompany H.R. 2800 presented to the Committee of the Whole House on the State of the Union by the Committee on Science and Technology, 99th Congress, 1st Session, 20 Jun. 1985
(HR-Rept-99-177; GPO-51-006) Avail: US Capitol, House Document Room

Amendments to the Land Remote Sensing Commercialization Act of 1984 to provide full authorization for the transfer to the private sector of the Federal Government's civil land remote sensing satellite (LANDSAT) system were summarized. Appropriations of $295 million for fiscal years 1985 through 1989, of which not more than $125 million is available for fiscal years 1985 and 1986, were authorized. Author

N86-22449# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
USE OF SPACE DEPENDENT ON DEVELOPMENT OF SPACE LAW M.S. Thesis
Gregory T. Noble Sep. 1985 147 p
(AD-A161397; AFIT/GLM/LSM/85S-57) Avail: NTIS HC A07/MF A01 CSCL 05/4

This thesis presents a brief background of the international law and legal bodies that exist for regulating the activities of man in space. This research additionally identifies specific areas where specified space law does not apply or where serious questions about legal applicability exist. One specific area, space militarization, is highlighted with the current legal deficiencies pertaining to this activity discussed in detail. Proposals are presented for dealing with the question of legal regulations over space militarization. These proposals, from the Soviet Union, United States, France and other lesser proposals, are evaluated in light of the problems they purport to solve. Recommendations are presented on what legal actions should be pursued in the space militarization issue, from the international and the U.S. national perspectives. Although recommendations are made, the overall conclusion is that legal control of space militarization in most respects is not feasible and the future for arms in space is unlikely to differ significantly from the history of arms on Earth. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-22450 Deutsche Lufthansa Aktiengesellschaft, Frankfurt am Main (West Germany).
[ACTIVITIES REPORT OF THE AEROSPACE INDUSTRY IN WEST GERMANY] Annual Report, 1985 [LUFTHANSA JAHRBUCH 85]
Hans-Joachim Allgaier, ed. 31 May 1985 360 p In GERMAN (ISSN-0176-5086) Copyright. Avail: Issuing Activity

Air traffic, air traffic market, efficiency, costs, Lufthansa national role and independence, and rates and regulation in civil aviation are discussed. The Airbus A320 program, the development of a propeller, the role of Lufthansa in aircraft development and in technical services, German cargo services, and aviation fuel are treated. Author (ESA)

N86-22451*# General Electric Co., Philadelphia, Pa.
TRANSFORMATION TOUGHENED CERAMICS FOR THE HEAVY DUTY DIESEL ENGINE TECHNOLOGY PROGRAM, PHASE 2 Final Report, Aug. 1984 - Jul. 1985
S. Musikant, S. C. Samanta, P. Architetto, and E. Feingold 1 Dec. 1985 86 p refs
(Contracts DEN3-339; DE-AI-80CS-50194)
(NASA-CR-175054; NAS 1.26:175054) Avail: NTIS HC A05/MF A01 CSCL 13F

The objective of this program is to develop an insulating structural ceramic for application in a heavy duty adiabatic diesel engine. The approach is to employ transformation toughening (TT) by additions of zirconia-hafnia solid solution (ZHSS). The feasibility of using ZHSS as a toughening agent in mullite and alumina has been demonstrated in Phase 1 of this work. Based on Phase 1 results, a decision was made to concentrate the Phase 2 effort on process optimization of the TT mullite. A strong factor in that decision was the low thermal conductivity and high thermal shock resistance of the mullite. Results of the Phase 2 effort indicate that optimum toughening of mullite by additions of ZHSS is difficult to achieve due to apparent sensitivity to morphology. The 48 ksi room temperature modulus-of-rupture (MOR) achieved in selected specimens is approximately 50% of the original strength target. The MOR deteriorated to 34 ksi at 800 C. Author

N86-22452*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PERSONNEL EMERGENCY CARRIER VEHICLE Patent Application
Otto H. Fedor and Lester J. Owens, inventors (to NASA) Filed 3 Jul. 1985 14 p
(NASA-Case-KSC-11282-1; NAS 1.71:KSC-11282-1;
US-Patent-Appl-SN-751644) Avail: NTIS HC A02/MF A01 CSCL 13F

A personnel emergency carrier vehicle is disclosed which includes a vehicle frame supported on steerable front wheels and driven rear wheels. A supply of breathing air is connected to quick connect face mask coupling and umbilical cord couplings for supplying breathing air to an injured worker or attendant either with or without a self-contained atmospheric protection suit for protection against hazardous gases at an accident site. A non-sparking hydraulic motor is utilized to drive the vehicle and suitable direction and throttling controls are provided for controlling the delivery of a hydraulic driving fluid from a pressurized hydraulic fluid accumulator. A steering axis is steerable through a handle to steer the front wheels through a linkage assembly. NASA

N86-22453# Mitre Corp., McLean, Va. METREK Div.
EXPLORING THE UTILITY OF A STAGED TECHNOLOGY ASSESSMENT PROCESS, VOLUME 1
R. Lay, E. Carlson, W. Fraize, G. Strasser, and G. Tomlinson Jan. 1985 78 p
(Grant NSF PRA-82-01177)
(PB86-109402; MTR-84W401-Vol-1; NSF/PRA-85013-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 05A

A procedure for selecting technology assessment candidates, and low cost, quick-response methodology for helping to decide, in advance of a major commitment of resources, whether a candidate warrants a full-scale effort are defined and evaluated. Selection of candidate technologies is addressed and the development of a baseline technology assessment (BLTA) is described. Conducting a BLTA includes five steps: technology definition, data gathering, review and analysis, preparation of recommendations, and monitoring and interpreting indicators. The BLTA is applied to two cases: higher energy-density battery technology and methanol as a fuel for spark-ignited automotive fuels. The BLTA approach is shown to have potential as a feasible, low cost method for indicating whether a full-scale in-depth technology assessment is warranted. GRA

N86-22454# Mitre Corp., McLean, Va. METREK Div.
EXPLORING THE UTILITY OF A STAGED TECHNOLOGY ASSESSMENT PROCESS, VOLUME 2
R. Lay, E. Carlson, W. Fraize, G. Strasser, and G. Tomlinson Jan. 1985 149 p refs 2 Vol.
(Grant NSF PRA-82-01177)
(PB86-109410; MTR-84W402-Vol-2; NSF/PRA-85014-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 05A

Technology assessment concepts were discussed in a workshop format. Subjects for technology assessment are reviewed, and biotechnology and automation emerge as dominant forces that may lead to potential discontinuities in the future. Resources and materials are also addressed, and water is identified as the top issue. Further, a number of topics are shown to center around the issues of industrial readiness; fragmentation of industry; relaxation of antitrust; impact of automation on labor markets; industrial readiness; collective research; and cooperation of labor, industry, and government. Finally, the status of the evolving baseline technology assessment methodology is reviewed, and the application of the methodology to high energy density storage systems is examined. GRA

N86-22455# Foersvarets Forskingsansalt, Stockholm (Sweden).
REPRESENTATION OF URBAN DISTRICTS IN A GEOGRAPHICAL INFORMATION SYSTEM
A. Andersson and E. Jungert Aug. 1985 33 p refs
(PB86-109451; FOA-C-30403-E1) Avail: NTIS HC A03/MF A01 CSCL 08A

Urban management and other similar fields where urban data are of interest are all main applications for geographical information systems (GIS). Hence, methods for representing urban districts in geographical information systems, must be investigated. The kind of information that might be of interest in various applications has to be analyzed as well. Different methods suitable for representation and generation of the map data in geographical information systems are described. GRA

88 SPACE SCIENCES (GENERAL)

N86-22456# Space Research Organization Netherlands, Utrecht.
[SPACE RESEARCH IN THE NETHERLANDS] Annual Report, 1984
1984 161 p refs
Avail: NTIS HC A08/MF A01

Dutch activities in solar research; astronomy in the ultraviolet and visual spectral region; cosmic X-ray astronomy; infrared

astronomy; spaceborne astronomy; gamma-ray astronomy; submillimeter wave astronomy; and crustal dynamics are described.
Author (ESA)

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-22457*# National Aeronautics and Space Administration, Washington, D.C.
METHOD OF DETERMINING THE THERMAL DEFORMATIONS OF ASTRONOMICAL MIRRORS
Ye. G. Khablo-Grossvald Dec. 1986 9 p refs Transl. into ENGLISH from Izvestiia (USSR), no. 186, 1971 p 189-191 Original language document was announced in IAA as A72-37968 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77941; NAS 1.15:77941) Avail: NTIS HC A02/MF A01 CSCL 03A

Procedures are given for calculating thermal fields and associated thermal deformations in astronomical mirrors. A technique is described for thermal strain simulation when complex thermal fields develop in astronomical mirrors. Thermal strains in pyroceramic, quartz and pyrex mirrors can be effectively determined at temperatures ranging from -70 to 150 C by this technique.
Author

N86-22458*# Delaware Univ., Newark.
A SEARCH FOR OUTFLOWS FROM X-RAY BRIGHT POINTS IN CORONAL HOLES Final Report
D. J. Mullan and W. L. Waldron (Applied Research Corp., Landover, Md.) 7 Apr. 1986 84 p
(Grant NAG5-504)
(NASA-CR-176647; NAS 1.26:176647) Avail: NTIS HC A05/MF A01 CSCL 03A

Properties of X-ray bright points using two of the instruments on Solar Maximum Mission were investigated. The mass outflows from magnetic regions were modeled using a two dimensional MHD code. It was concluded that mass can be detected from X-ray bright points provided that the magnetic topology is favorable.
E.R.

N86-22459*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTISPECTRAL GLANCING INCIDENCE X-RAY TELESCOPE Patent Application
Richard B. Hoover, inventor (to NASA) Filed 15 Aug. 1986 16 p
(NASA-Case-MFS-28013-1; NAS 1.71:MFS-28013-1;
US-Patent-Appl-SN-765979) Avail: NTIS HC A02/MF A01 CSCL 03A

A multispectral glancing incidence X-ray telescope is illustrated capable of broadband, high-resolution imaging of solar and stellar X-ray and extreme ultraviolet radiation sources which includes a primary optical system preferably of the Wolter I type having a primary mirror system. The primary optical system further includes an optical axis having a primary focus at which the incoming radiation is focused by the primary mirrors. A plurality of ellipsoidal mirrors are carried at an inclination to the optical axis behind the primary focus. A rotating carrier is provided on which the ellipsoidal mirrors are carried so that a desired one of the ellipsoidal mirrors may be selectively positioned in front of the incoming radiation beam. In the preferred embodiment, each of the ellipsoidal mirrors has an identical concave surface carrying a layered synthetic microstructure coating tailored to reflect a desired wavelength of 1.5A or longer. Each of the identifical ellipsoidal mirrors has a second focus at which a detector is carried. Thus the different wavelength image is focused upon the detector irregardless of which mirror is positioned in front of the radiation beam.
NASA

N86-22460*# Auburn Univ., Ala. Dept. of Physics.
SURFACE ANALYSIS OF SPACE TELESCOPE MATERIAL SPECIMENS Final Report
Albert Thomas Fromhold and Kasra Daneshvar 15 Jun. 1985 120 p
(NASA Order H-78184B)
(NASA-CR-178712; NAS 1.26:178712) Avail: NTIS HC A06/MF A01 CSCL 03A

Qualitative and quantitative data on Space Telescope materials which were exposed to low Earth orbital atomic oxygen in a controlled experiment during the 41-G (STS-17) mission were obtained utilizing the experimental techniques of Rutherford backscattering (RBS), particle induced X-ray emission (PIXE), and ellipsometry (ELL). The techniques employed were chosen with a view towards appropriateness for the sample in question, after consultation with NASA scientific personnel who provided the material specimens. A group of eight samples and their controls selected by NASA scientists were measured before and after flight. Information reported herein include specimen surface characterization by ellipsometry techniques, a determination of the thickness of the evaporated metal specimens by RBS, and a determination of trace impurity species present on and within the surface by PIXE.
Author

N86-22461# European Space Agency, Paris (France).
PROCEEDINGS OF AN ESA WORKSHOP ON A COSMIC X-RAY SPECTROSCOPY MISSION
Norman Longdon, comp. and Olga Melita, comp. Sep. 1985 315 p refs Workshop held in Lyngby, Denmark, 24-26 Jun. 1985
(ESA-SP-239; ISSN-0379-6566) Avail: NTIS HC A14/MF A01

The ESA multi mirror module X-ray observatory (XMM) was discussed. Research in X-ray astrophysics with XMM; X-ray optics; and XMM and other X-ray astronomy instrumentation were considered. For individual titles, see N86-22462 through N86-22505.

N86-22462# Mullard Space Science Lab., Dorking (England).
CAPABILITIES OF SPECTROSCOPY IN THE CONTEXT OF X-RAY ASTRONOMY IN THE 1900'S
J. L. Culhane *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 5-14 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The mission philosophies and parameters of the NASA AXAF and ESA XMM X-ray astronomy observatories are reviewed. The scientific topics that require an observatory of the XMM class are outlined and the relevance of angular and spectral resolution to these aims is discussed. The observing requirements of surveys and point source detection; galatic clusters; active galatic nuclei; normal galaxies and halos; stars; X-ray binaries; supernova remnants; and the interstellar medium are considered.
Author (ESA)

N86-22463# Cambridge Univ. (England). Inst. of Astronomy.
THE X-RAY BACKGROUND **c93**
Paul Guilbert *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 15-18 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The spectrum of the X-ray background is discussed. Although fairly accurately measured, particlarly in the 3 to 100 keV energy range, its origin is uncertain. It is very isotropic and its bremsstrahlung-like spectrum in this energy range indicates a diffuse intergalactic gas as the source, but this is probably ruled out on cosmological grounds. Point sources with measured spectra cannot make up the background as their spectra are too steep. Evolution of these sources is expected, however, at the low and high luminosity limits. A major task of XMM spaceborne observatory is to measure the spectra of faint extragalactic sources at energies above 3 keV in order to identify the kinds of sources which make up the background.
Author (ESA)

N86-22464*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for High Energy Astrophysics.
THE X-RAY SPECTROSCOPY OF ACTIVE GALACTIC NUCLEI
Richard Mushotzky *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 19-23 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01 CSCL 03A

The scientific goals of X-ray spectroscopy of active galactic nuclei are discussed. The underlying energy source, the regions responsible for the optical emission lines, the different types of active galaxies, and cosmology are considered. The requirements for an X-ray mission of broad band width, large collecting area, modest spatial resolution and good spectral resolution are outlined. It is concluded that the ESA XMM mission meets these requirements. Author (ESA)

N86-22465# Copenhagen Observatory (Denmark).
HIGH RESOLUTION X-RAY SPECTROSCOPY OF CLUSTERS OF GALAXIES
H. U. Noorgaard-Nielsen *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 25-31 refs (For primary document see N86-22461 12-89)
(Grant DSB-1112-4/85)
Avail: NTIS HC A14/MF A01

The prospects for studying the X-ray emission from clusters of galaxies with the ESA observatory XMM are discussed. The improvement in sensitivity and spectral resolution of a factor of 10 to 100 means that detailed knowledge of the temperature and chemical abundance profiles can be obtained, an essential issue for further investigation of the cool X-ray components. High resolution Bragg spectroscopy resolves the Fe line at 6.7 keV and the kinematics of the X-ray gas can be studied in detail. For clusters of galaxies at z = 1, the medium resolution detectors provide information on temperature, abundances, and an estimate of the redshift. By combining the spectral data with direct imaging of the clusters, insight into cluster formation and evolution can be achieved. The optimal spatial resolution for these investigations are also discussed. It is shown that ROSAT, XMM and AXAF (NASA) complement each other in the study of clusters of galaxies. Author (ESA)

N86-22466*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
THE X-RAY PROPERTIES OF NORMAL GALAXIES. WHAT DO WE KNOW AND WHAT CAN WE LEARN WITH THE NEXT GENERATION OF X-RAY TELESCOPES?
G. Fabbiano *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 33-41 refs (For primary document see N86-22461 12-89)
(Contract NAS8-30751)
Avail: NTIS HC A14/MF A01 CSCL 03A

Einstein Observatory results are used to assess the possibilities of spaceborne X-ray astronomy projects such as XMM (ESA) and AXAF (NASA). Einstein observations show that normal galaxies of all morphological types are spatially extended sources of X-ray emission with 0.5 to 3.0 keV X-ray luminosities of 10 to the 39th to 41st power erg/sec. X-ray telescopes can study the end products of stellar evolution in galaxies of different morphological types. Phenomena linked to starburst nuclear activity can best be detected and studied in X-ray. Hot coronae or a hot phase of the interstellar medium can only be studied through their X-ray emission. It is shown that high spatial resolution is essential for studying normal galaxies and identifying different emission regions. Good spectral sensitivity and spectral imaging capability are essential for gaining a deeper understanding of the phenomena at work. Author (ESA)

N86-22467# Netherlands Foundation for Radio Astronomy, Dwingelo.
THE X-RAY SPECTROSCOPY OF SUPERNOVA REMNANTS
R. G. Strom *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 43-47 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Properties of the X-ray spectra of 20 galactic supernova remnants (SNR) and 6 in the Large Magellanic Cloud are reviewed. Uses of such data, including deciding whether the emission is predominantly thermal or nonthermal, determining excitation temperatures, and studying SNR kinematics are considered. Instrumental requirements important for X-ray spectroscopy of SNR are treated. Of particular importance to studies of galactic remnants are a substantial field of view, capability at an energy high enough to mitigate the effects of interstellar absorption, and sufficient angular resolution to permit spectroscopy of spatially distinct components. The requirements which such considerations place on the XMM ESA observatory are discussed. Author (ESA)

N86-22468# Observatoire de Besancon (France).
ACCRETING NEUTRON STARS IN CLOSE BINARY SYSTEMS **c90**
Sergio A. Ilovaisky *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 49-58 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Knowledge about accretion phenomena on neutron stars in X-ray binary systems is reviewed. The role played by X-ray spectroscopic measurements, particularly results from the TENMA and EXOSAT X-ray observatories, is emphasized. Author (ESA)

N86-22469# Osservatorio Astronomico, Palermo (Italy).
STELLAR ACTIVITY: THE X-RAY PICTURE **c90**
S. Serio *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 59-67 refs Sponsored by Italian Ministry for Public Education (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The post Einstein generation of stellar X-ray observations is discussed. Studies should include the origin of X-ray emission in early type stars; the dependence of the late type stellar X-ray emission on parameters such as age, rotation rate, and the depth of the convection zone; the determination of the boundary of the region of the HR diagram in which dynamo activity is present; the contribution of flares and winds to the mass budget of the interstellar medium and to the cosmic ray flux; and the geometrical and thermal structure of late type coronae. A moderate throughput X-ray telescope devoted to a full sky survey, such as ROSAT's, or a high spatial and spectral resolution observatory, such as NASA's AXAF, will advance knowledge in these areas. However, because of the low inherent stellar X-ray fluxes, a large part of the population studies relevant to the problems outlined above, and conducted to the faint limits as required, has to wait for the High Throughput X-ray mission. Author (ESA)

N86-22470# Nagoya Univ. (Japan). Dept. of Astrophysics.
THE X-RAY SPECTROSCOPIC STUDY OF THE INTERSTELLAR MEDIUM
S. Hayakawa *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 69-76 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Results of low resolution X-ray spectroscopy are described to show how the properties of interstellar and circumstellar media are obtained. Further information to be obtained with higher spectral resolutions is discussed by reference to the observations of emission lines, absorption lines and absorption edges. Once the emission lines or the absorption edges are observed, the results are more simply related to plasma properties than those in other ranges, since the optical depth in the X-ray range is in most cases smaller and radiation transfer is less complicated. For the study of hot plasmas, X-ray spectroscopy provides more direct means, while allowed transitions in the XUV range for the same ions are weaker and not always observable because of strong interstellar absorption. Advantages in X-ray spectroscopy counterbalance disadvantages due mainly to the difficulty in collecting enough photons. Author (ESA)

N86-22471# Danish Space Research Inst., Lyngby.
INSTRUMENTATION FOR X-RAY SPECTROSCOPY **c19**
Herbert W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 77-86 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Concentrator, spectroscopic, and imaging systems likely to be available when payload decisions for ESA's High Throughput X-ray Mission are made are described. Collecting area, spectral resolution, spatial resolution, and energy range are summarized, and the sensitivity of various combinations suitable for specific observational programs are illustrated. Author (ESA)

N86-22472# Osservatorio Astronomico, Rome (Italy).
THE X-RAY SPECTRUM OF EMISSION LINE STARS (SUPERLUMINOUS AND SYMBIOTIC)
G. B. Baratta, L. Piro (CNR, Bologna, Italy), R. Viotti (CNR, Frascati, Italy), A. Cassatella (ESA, Madrid, Spain), A. Altamore (Rome Univ., Italy), O. Ricciardi (Rome Univ., Italy), and M. Friedjung (CNRS, Paris, France) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 95-98 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The observation of the X-ray spectrum of peculiar emission line stars, whose atmospheric envelopes are characterized by extreme physical conditions, as a tool to investigate the processes of formation of high temperature plasmas is discussed. The superluminous object Eta Car, showing high and low temperature regions and an asymmetric wind, is described. EXOSAT observations of symbiotic stars are presented. Observations of AG Draconis at a minimum phase show a low temperature X-ray spectrum. A weak flux from the Mira variable R Aqr observed near maximum is also detected. Author (ESA)

N86-22473# Osservatorio Astronomico, Turin (Italy).
OPTICAL, UV AND X-RAY OBSERVATIONS OF X-RAY BINARIES
Luciana Bianchi and Manfred Pakull (Tech. Univ., Berlin, West Germany) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 99-106 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

X-ray binary candidates in the Galaxy and in the Magellanic Clouds were observed in the optical, far ultraviolet, and X-ray bands. Results on two sources for which the photometric and spectroscopic data suggest the presence of an accretion disk are presented. For another source (LMC X-1) observational evidence of interaction of the strong X-ray source with the surrounding HII region, and the discovery of an X-ray ionized HeIII region, are shown. Author (ESA)

N86-22474# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
NONIONIZATION EQUILIBRIUM EFFECTS IN THE SUPERNOVA REMNANT (SNR) RCW 86
J. J. Claas (Space Research Lab., Leiden, Netherlands) and A. Peacock *In its* Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 107-110 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Using nonionization models, the analysis of EXOSAT low energy X-ray data (0.4 to 2 keV) of the supernova remnant RCW 86 reveals a shell-like structure, consisting of 2 separate parts, producing relatively hard and soft X-rays respectively. The soft X-rays come from C-K and O-K emission lines, which implies a low NH (< or = 10 to the 20th power atoms/sqcm). The harder X-rays probably result from the Fe-L complex and Ne-K line. A low NH value may also imply the distance to be 1.6 kpc or slightly more. Author (ESA)

N86-22475# Tokyo Univ. (Japan). Dept. of Earth Science and Astronomy.
THE X-RAY SPECTRA OF BURSTING NEUTRON STARS: EFFECTS OF COMPTONIZATION AND BOUND-FREE OPACITY
Toshikazu Ebisuzaki and Kenichi Nomoto *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 111-116 refs Sponsored by Space Data Analysis Center, Inst. of Space and Aeronautical Science (For primary document see N86-22461 12-89)
(Grants MIN-ESC-58340023; MIN-ESC-59050046; MIN-ESC-60540152)
Avail: NTIS HC A14/MF A01

Atmospheric models and emitted X-ray spectra are calculated for X-ray bursting neutron stars taking into account the effects of Comptonization and free-free and bound-free emission and absorption. The color temperatures obtained from the calculated X-ray spectra are significantly higher than the effective temperatures. The theoretical color temperature to luminosity diagram is in good agreement with the observational diagram of MXB 1636-536 observed with TENMA and Exosat. Author (ESA)

N86-22476# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
ON THE VARIABILITY OF SIGMA GEMINORUM: AN INTERESTING CANDIDATE FOR X-RAY STUDIES
O. Elgaroey, O. Engvold, and P. Joraas *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 117-120 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Observations of Sigma Gem in UV show that high excitation line fluxes increase with the emergence of a dark region from behind the approaching limb. A moderate increase in X-ray intensity occurs, together with the coming into view of another, weaker, spot region. Further observations of rotational modulation effects are desirable. Author (ESA)

N86-22477# Bogazici Univ., Istanbul (Turkey). Kandilli Observatory.
EXOSAT CMA OBSERVATIONS OF X0512-401 = NGC 1851
E. N. Ercan, U. Kiziloglu (Middle East Tech. Univ., Ankara, Turkey), A. Esendemir (Middle East Tech. Univ., Ankara, Turkey), F. Tokedemir (Middle East Tech. Univ., Ankara, Turkey), and G. Branduardi-Raymont (Mullard Space Science Lab., Dorking, England) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 121-125 refs Sponsored by Turkish Education and Research Foundation (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

EXOSAT observations of the globular cluster X-ray source X0512-401=NGC1851 are reported. The observations covered 20,000 sec and were carried out with Lexan thin, aluminum Parylene and boron filters: these yielded counting rates of (6.83 + or - 0.57) x 0.1, (4.54 + or - 0.44) x 0.1, and (1.95 + or - 0.54) x 0.1 counts/sec respectively. Results of three-color spectroscopy are presented. Long (6 hr) uninterrupted, simultaneous soft and medium energy X-ray curves of X0512-401 are given.
Author (ESA)

N86-22478# Kapteyn Astronomical Lab., Roden (Netherlands).
A RELATIVISTIC ROTATING MASSIVE OBJECT WITH SATURATION OF MAGNETIC MONOPOLES **c90**
Qiuhe Peng *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 127-128 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The critical content of monopoles, with which the horizon of the metric for the rotating object would disappear, and the saturation content of monopoles in a relativistic rotating object are found. Although the critical value cannot be reached, induced nucleon decay by monopoles prevents the massive object (galactic nuclei and quasars) from collapsing into a black hole. For a fast rotating collapsed object, with radius close to the Schwarzschild radius, the saturation content of monopoles in the polar regions is much more than that in the equator region, if a/R > or = 6.5*0.01. Author (ESA)

N86-22479# Kapteyn Astronomical Lab., Roden (Netherlands).
FORCES EXERTING ON A TEST PARTICLE OUTSIDE A RELATIVISTIC ROTATING MASSIVE OBJECT WITH SATURATION OF MAGNETIC MONOPOLES AND JETS FROM THE OBJECT
Qiuhe Peng *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 129-130 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The forces on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles are calculated. For a fast rotating collapsed massive object (such as galactic nuclei and quasars) with saturation of monopoles, most material and monopoles are driven into and concentrated in the polar regions. Due to the induced nucleon decay by monopoles, two jets in the opposite direction are ejected from the polar regions. Author (ESA)

N86-22480*# Pennsylvania State Univ., University Park.
SOFT X-RAY MAPS OF THE LARGE MAGELLANIC CLOUD (LMC)
K. P. Singh, J. A. Nousek, D. N. Burrows, and G. P. Garmire *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 131-136 refs (For primary document see N86-22461 12-89)
(Contract NAS5-26809)
Avail: NTIS HC A14/MF A01 CSCL 03A

Soft X-ray maps of the Large Magellanic Cloud (LMC) were obtained from scanning-observations with the HEAO-1 low energy detectors. Comparison of the 1/4 keV X-ray observations with the neutral hydrogen column densities in the LMC obtained from a 21 cm line survey, shows no evidence for absorption effects in the 1/4 keV X-ray flux from the LMC due to the neutral matter in the LMC. Instead, faint X-ray emission is detected from the LMC. The extent of this emission is smaller than the size of the halo or the disk of the LMC. Assuming this 1/4 keV emission to be diffuse, it is identified with a supergiant shell of optical nebulosity known as Shapley III, and the bar of the LMC. The X-ray luminosities of the regions are estimated to be 9 times 10 to the 38th power ergs/sec and 1.8 times 10 to the 39th power ergs/sec for the Shapley III region and the bar of the LMC respectively. Shapley III could be an X-ray superbubble. Author (ESA)

N86-22481# Science Research Council, Chilton (England).
INTERPRETATION OF THE OXYGEN 7 SOFT X-RAY SPECTRUM FROM THE PUPPIS-A SUPERNOVA REMNANT
A. H. Gabriel, L. W. Acton (Lockheed Research Lab., Palo Alto, Calif.), F. Bely-Dubau (Observatoire de Nice, France), and P. Faucher (Observatoire de Nice, France) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 137-140 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The soft X-Ray line spectrum from Puppis-A recorded with the Einstein observatory shows line ratios different from those anticipated. Previous interpretations were based upon high temperatures (> 5 million K) and departures from ionization equilibrium. It is shown that an alternative model can fit the observations, in which 1% of fast electrons are present in an otherwise thermal plasma at 1 to 2 million K. This plasma can be in steady-state ionization balance. Author (ESA)

N86-22482*# Wroclaw Univ. (Poland). Inst. of Astronomy.
THE X-RAY SPECTRA AND THE ROTATION-ACTIVITY CONNECTION OF RS CVN BINARIES
P. Majer, J. H. M. M. Schmitt (Max-Planck Inst. fuer Extraterrestrische Physik, Garching, West Germany), L. Golub (Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.), F. R. Harnden, and R. Rosner *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 141-147 refs (For primary document see N86-22461 12-89)
(Contract NAS8-30751; Grant NAG8-445)
Avail: NTIS HC A14/MF A01

Results from a survey of RS CVn binaries which were observed with the Imaging Proportional Counter (IPC) on board the Einstein Observatory are presented. Spectral analyses of the IPC pulse height spectra show that the coronae of RS CVn binaries always contain hot gas with temperatures > 10 million K, similar to active late-type main sequence stars, and that at least 2 temperature components are necessary to account for the higher quality IPC spectra (when absorption is unimportant). It is argued that these bimodal temperature distributions indicate true distributions of emission measure vs temperature that are continuous (just as is the case for magnetically-confined coronal plasma loops observed on the Sun). It is shown that none of the derivable X-ray characteristics of RS CVn binaries depend on rotation period, implying that claims of period-activity relationships in RS CVn binaries are unfounded. Author (ESA)

N86-22483# Tokyo Univ. (Japan). Inst. of Space and Astronomical Science.
IRON K X-RAY EMISSION LINES FROM COSMIC X-RAY SOURCES OBSERVE WITH TENMA
Masaru Matsuoka *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 149-154 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Gas scintillation proportional counters on board TENMA detected iron K X-rays at an energy of 6.5 keV from binary X-ray pulsars. This is satisfactorily explained by a picture in which continuum X-rays originating from a compact region excite fluorescent K X-rays in the surrounding cold matter. Intense K X-rays at 6.4 keV are detected from the Seyfert galaxy NGC4151. The emission line at an energy of 6.7 keV is observed from nonpulsating low mass X-ray binaries and Cyg X-3. This is also explained by fluorescent mechanisms in a hot gas region. On the other hand intense 6.7 keV lines are detected from supernova remnants, clusters of galaxies, and the galactic ridge on the plane. Various emission lines as well as the 6.7 keV lines are produced from hot plasma region in these sources. Author (ESA)

N86-22484# Copenhagen Observatory (Denmark).
EXOSAT OBSERVATIONS OF THE POOR CLUSTER OF GALAXIES 2A0335+096
H. U. Noorgaard-Nielsen, N. J. Westergaard (Danish Space Research Inst., Lyngby), L. Hansen, H. E. Joergensen, and H. W. Schnopper (Danish Space Research Inst., Lyngby) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 155-157 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

EXOSAT observed 2A0335+096 for 10hr. The low energy image shows an irregular structure, and the X-ray emission is not centered on the dominant galaxy. Optical emission lines are seen from a large region, and they indicate normal composition, whereas the medium energy spectrum suggests a very low metal content, implying that the ionized gas seen optically is not a product of the cooling flow inferred from previous X-ray observations. Author (ESA)

N86-22485# Danish Space Research Inst., Lyngby.
THE HYADES: EXOSAT BROAD BAND SPECTROSCOPY
Niels J. Westergaard, Hans Ulrik Noorgaard-Nielsen (Copenhagen Observatory, Denmark), Leif Hansen (Copenhagen Observatory, Denmark), H. E. Joergensen (Copenhagen Observatory, Denmark), I. L. Rasmussen, and H. W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Scpectroscopy Mission Sep. 1985 p 159-162 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Two EXOSAT observation fields of the Hyades star cluster were combined with Einstein proportional counter data for three band filter spectroscopy. Although temporal variations disturb the picture, the coronal temperatures in nine stars are confined to the few million degree range. The column density is probably 1 or 2 times 10 to the 19th power/sqcm. Author (ESA)

N86-22486# State Univ. of Western Connecticut, Danbury.
LONG-TERM X-RAY VARIABILITY IN THE HYADES CLUSTER
Marie-Christine Zolcinski and Robert A. Stern (Lockheed Research Lab., Palo Alto, Calif.) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 163-169 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Twenty Hyades stars were observed over a period of 1.5 yr, by EXOSAT. Reliable results are obtained for seven of them. Only one star, the KOIII giant theta prime TAU does not exhibit X-ray variability. This result casts doubt about the activity cycle being the explanation for the wide range of X-ray luminosities seen among the Hyades giants. The 6 other dwarfs exhibit variability on a time scale of few days to 1.5 yr. Assuming that the X-ray emission is of coronal origin, implications on the stellar coverage variations are drawn. Author (ESA)

N86-22487# Lockheed Aircraft Corp., Palo Alto, Calif.
LIGHT WEIGHT ALUMINUM OPTICS
R. C. Catura and J. R. Vieira *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 173-175 (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Light weight mirror blanks were fabricated by dip-brazing a core of low mass aluminum foam material to thin face sheets of solid aluminum. The blanks weigh 40% of an equivalent size solid mirror and were diamond turned to provide reflective surfaces. Optical interferometry was used to assess their dimensional stability over 7 months. No changes in flatness are observed (to the sensitivity of the measurements of a half wavelength of red light). Author (ESA)

N86-22488*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
THE LAMAR TELESCOPE MODULE FOR HIGH THROUGHPUT IMAGING AND SPECTROSCOPY
P. Gorenstein, D. Fabricant, and L. Cohen *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 177-182 refs (For primary document see N86-22461 12-89)
(Contract NAS5-26613; Grant NsG5-138)
Avail: NTIS HC A14/MF A01 CSCL 03A

Kirkpatrick-Baez mirror assemblies for the LAMAR experiment of the Space Shuttle are described. The aperture is 20 cm x 30 cm and the distance from the front of the mirror to the focal plane is 3.4 m. The reflectors are made from 1.8 mm gold coated float glass. A prototype brassboard mirror was constructed with only one-third of the plates. Its angular resolution is 35 arcsec (HPW) in visible light. X-ray tests over small areas indicate very little scattering. The fabrication technique is applicable to larger mirror systems such as those of XMM. The use of flatter material for the reflectors results in better angular resolution. Author (ESA)

N86-22489# Danish Space Research Inst., Lyngby.
A THIN FOIL HIGH THROUGHPUT X-RAY TELESCOPE
P. Loekke Jensen and N. J. Westergaard *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 183-187 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

A thin foil reflector X-ray telescope was proposed for a high throughput spectroscopic satellite (XMM). A prototype of a single quadrant was built and the precision of test mirrors is being measured. Three types of foils are studied: rolled aluminum, electroformed Ni, and carbon fiber reinforced epoxy. Evaluation of the performance based on measurements by ray tracing gives a half energy width = 5.4', but improvements are possible. Author (ESA)

N86-22490# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
CARBON-FIBER REINFORCED EPOXY TECHNIQUES FOR THE X-RAY MULTIMIRROR MISSION (XMM) LOW-ENERGY (LE) TELESCOPES **c24**
P. A. J. deKorte (Space Research Lab., Leiden), J. Klug, G. Moreau (Instruments SA, France), and G. P. Whitcomb (ESA/ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 189-193 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

A development study for low energy telescopes for the X-ray Multi-Mirror mission (XMM) was performed. An X-ray paraboloidal mirror was fabricated by the replica method developed for EXOSAT. Instead of the use of a beryllium carrier, the use of a carbon-fiber reinforced epoxy carrier, which would have a big advantage for the mass production envisaged, was studied. Results show the feasibility of the technique, in spite of problems with long term shape stability and print through of the fiber pattern in the optical surface. Author (ESA)

N86-22491*# Northwestern Univ., Evanston, Ill. Dept. of Physics and Astronomy.
ELECTROFORM REPLICATION OF GRAZING INCIDENCE X-RAY OPTICS **c74**
M. P. Ulmer, W. R. Purcell, D. Bedford (Birmingham Univ., England), and G. R. Simnett (Birmingham Univ., England) *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 195-198 ref Sponsored by UK Science and Engineering Research Council (For primary document see N86-22461 12-89)
(Grant NAG5-181)
Avail: NTIS HC A14/MF A01

Work to produce mirrors via electroform replication is reported. Work on small (6 cm by 9 cm) cylindrical pieces and on 40 cm long by 12 cm wide Wolter shaped mirrors is summarized. It is shown that electroforming is a viable technique for producing relatively inexpensive grazing incidence X-ray optics, as long as modest resolution (1 min of arc) and size (12 cm diameter by 40 cm long) are specified. Author (ESA)

N86-22492# Laboratorium voor Ruimteonderzoek, Utrecht (Netherlands).
DISPERSIVE X-RAY SPECTROSCOPY WITH TRANSMISSION GRATINGS
F. Paerels, J. A. M. Bleeker, A. C. Brinkman, J. H. Dijkstra, R. Mewe, and C. J. Schrijver *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 205-208 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The possibilities for plasma diagnostics with high throughput grating spectrometers are illustrated by presenting spectra of a coronal X-ray source (Capella), a Seyfert Galaxy (NGC 4151) and a BL Lac object (PKS 2155-304). Einstein and EXOSAT spectra are contrasted with computer-simulated AXAF or XMM spectra, to illustrate the increase of insight expected from grating spectroscopy with these instruments. Author (ESA)

N86-22493# Danish Space Research Inst., Lyngby.
THE XMM IMAGING BRAGG SPECTROMETER WITH A DOUBLY CURVED CRYSTAL **c74**
B. Byrnak, F. E. Christensen, N. J. Westergaard, and H. W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 209-212 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

A spaceborne X-ray astronomy spectrometer sensitive in the energy range from 0.5 to 7 keV is presented. The Bragg reflected rays from a doubly bent crystal positioned downstream of the focal plane of a grazing-incidence concentrator are focused along the axis of a position sensitive detector. The main advantages are: simultaneous (scanning free) coverage of the spectral range of interest, nearly stigmatic imaging, and crystal limited resolution. Author (ESA)

N86-22494# Danish Space Research Inst., Lyngby.
MEASUREMENTS OF INTRINSIC WIDTH AND MOSAICITY OF

TEST CRYSTALS WITH A NOVEL FOUR-CRYSTAL X-RAY SPECTROMETER c76

F. E. Christensen, H. W. Schnopper, E. H. Silver (LLNL, Berkeley, Berkeley, Calif.), and N. J. Westergaard *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 213-220 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

An X-ray study of test crystals for which the mosaicity and the perfection of the microcrystallites were measured was performed for the XMM X-ray spectrometer. These parameters play a significant role in determining the overall efficiency and the achievable energy-resolution of the XMM spaceborne spectrometer. The measurements were done with a four crystal X-ray spectrometer using three perfect quartz-crystals as beam defining element. Results from measurements on test crystals ranging from LiF(2d = 2.85A) to KAP(2d = 26.6A) are presented. The measurements were performed on flat crystal pieces. The results are very encouraging for application of the proposed crystals as dispersive elements in a high resolution dispersive spectrometer for X-ray astronomy. Author (ESA)

N86-22495# Danish Space Research Inst., Lyngby.

MEASUREMENTS OF SURFACE SCATTERING FROM MIRRORED SURFACES USING A TRIPLE AXIS X-RAY SPECTROMETER

F. E. Christensen, P. L. Jensen, and H. W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 221-228 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

In developing a high throughput X-ray telescope for XMM, various techniques were employed to deposit a thin film of Au on a smooth substrate. A triple axis X-ray spectrometer was employed to measure the reflectivity and surface scattering of the gold surface or the substrates. For comparison, the same kind of measurements were performed on a high quality Au-coated test flat for EXOSAT and a Pt-coated test flat for AXAF. In the triple axis spectrometer a perfect channel cut Si crystal extracts Fe K radiation from a conventional X-ray tube. The X-rays are incident on the thin film surface at grazing angles and the specularly reflected and scattered radiation from the thin film is analyzed by another perfect Si crystal. A tailless probe of the scattered X-rays is obtained when the X-rays are reflected several times through a channel in each of the perfect Si crystals. It is demonstrated that the technique provides an excellent and detailed test of the quality of the mirror surface. Author (ESA)

N86-22496# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France).

BOLOMETERS AS SPECTROMETERS FOR X-RAY ASTRONOMY c35

N. Coron, G. Artzner, G. Dambier, G. Jegoudez, J. Leblanc, J. Y. Deschamps (CEA, Saclay, France), R. Rocchia (CEA, Saclay, France), A. Tarrius (CEA, Saclay, France), O. Testard (CEA, Saclay, France), H. R. Ravn (CERN, Geneva, Switzerland) et al *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 229-231 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

Use of composite diamond-germanium bolometers developed for IR astronomy for the individual detection of X-ray photons was investigated. The advantage of a composite bolometer is that it separates the absorption and detection functions. Diamond, as absorber, is especially interesting because of its high thermal diffusivity and low heat capacity. The thermalization time of the whole device for a 1 x 1 mm absorber is < 50 microsec, allowing detection of a few tens or hundreds counts per second without degradation of the spectral resolution. The theoretical energy resolution is proportional to T C1/2 where C, the specific heat of the bolometer, is a rapidly decreasing function of the temperature T. The expected value is < 10eV at 0.1K. Associated with a 1000 sqcm telescope, such a device, whose performance is essentially signal limited, is able to detect an emission line of 0.000001 ph/sqcm/sec in 100,000 sec in the spectrum of a faint X-ray source. Author (ESA)

N86-22497# Consiglio Nazionale delle Ricerche, Bologna (Italy). Ist. di Technologie e Studio delle Radiazioni Extraterrestri.

ROOM TEMPERATURE SOLID STATE SPECTROMETER FOR X-RAY ASTRONOMY c35

G. DiCocco, W. Dusi, C. Labanti, G. F. Spada, G. Ventura, and P. Siffert *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 233-236 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

The use of room temperature HgI2 solid state X-ray spectrometers in spaceborne experiments is proposed. The main factors which characterize the behavior of HgI2 detectors and their related electronics are presented. The performance of a position sensitive spectrometer, based on experimental results on HgI2 detectors, is described, and its application as a focal plane detector for X-ray imaging concentrators is suggested. Author (ESA)

N86-22498# California Univ., Berkeley. Dept. of Physics.

THE APPLICATION OF REFLECTION GRATINGS TO A LARGE AREA X-RAY SPECTROSCOPY MISSION: A DISCUSSION OF SCIENTIFIC REQUIREMENTS AND VARIOUS DESIGN OPTIONS c74

Steven M. Kahn and Michael C. Hettrick *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 237-244 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

Grazing incidence reflection grating design options for faint X-ray source spaceborne observation are considered. Geometries based on objective gratings and convergent beam varied line-space gratings are discussed. In-plane (classical) and off-plane (conical) grating mountings are compared. Author (ESA)

N86-22499# Danish Space Research Inst., Lyngby.

A MULTIWIRE PROPORTIONAL COUNTER FOR LOW ENERGY X-RAY IMAGING c35

M. M. Madsen, P. Jonasson, P. L. Jensen, H. E. Rasmussen, P. Orup, and H. W. Schnopper *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 245-254 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

Development of a detector for a high spectrometral resolution imaging Bragg spectrometer experiment including the test set-up and the read-out electronics is described. Examples of the position resolution at X-ray energies from aluminum and manganese K radiation (1.49 and 5.9 keV) are presented. A computer controlled test-stand with: a 50 micron collimated X-ray beam from a fine focus X-ray tube with replaceable anode caps; an X-ray translation table for positioning the detector; and an electronics system using the charge division method for event position determination was developed. Charge pulses from the detector are digitized and analyzed in a microprocessor where the position and energy spectra are stored. Background rejection is determined by energy, position, and risetime windows in the microprocessor software. Author (ESA)

N86-22500# Columbia Univ., New York. Astrophysics Lab.

X-RAY POLARIMETRY ON XMM c74

R. Novick, G. Chanan, and D. J. Helfand *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 265-275 refs (For primary document see N86-22461 12-89)

Avail: NTIS HC A14/MF A01

It is proposed that a single XMM Mirror Module be devoted to X-ray polarimetry. The instrument would exploit the polarization dependence of Bragg reflection from a variety of crystals and Thomson scattering from a lithium target. It would be sensitive over the full bandwidth of the mirror and could be used for studies of as many as 50 different astrophysical objects. The crystals

would provide measurements at discrete energies which could constrain the disk and/or wind geometries in X-ray binaries, constrain the radiation mechanisms in active galactic nuclei, and establish the existence of nonthermal components in supernova remnants. Broadband measurements with the lithium could be used to search for the dragging of inertial frames around the suspected black hole in Cyg X-1. Author (ESA)

N86-22501# Commissariat a l'Energie Atomique, Saclay (France). Service d'Astrophysique.
A MULTIPLEX CODING IMAGING SPECTROMETER FOR X-RAY ASTRONOMY
R. Rocchia, J. Y. Deschamps, L. Koch-Miramond, and A. Tarrius *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 277-281 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

A multiplex coding system associated with a solid state spectrometer Si(Li) to be placed at the focus of a grazing incidence telescope is described. The spectrometric and imaging functions are separated. The coding system consists of a movable mask with pseudo randomly distributed holes, located in the focal plane of the telescope. The pixel size lies in the range 100 to 200 microns. The close association of the coding system with an Si (Li) detector gives an imaging spectrometer combining the good efficiency (50% between 0.5 and 10 keV) and energy resolution (90 to 160 eV) of solid state spectrometers with the spatial resolution of the mask. Simulations and results obtained with a laboratory model are presented. Author (ESA)

N86-22502# Danish Space Research Inst., Lyngby.
OBJECTIVE CRYSTAL SPECTROMETER (OXS) FOR IMAGING EXTENDED COSMIC X-RAY SOURCES c35
H. W. Schnopper and B. Byrnak *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 283-286 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Results from HEAO-2 and EXOSAT demonstrate the need for a high resolution imaging spectrometer capable of studying sources with appreciable angular extent (up to 1 to 2 deg). Instruments which utilize curved Bragg crystals following the telescope as proposed for XMM and AXAF do not possess a sufficiently large field of view (FOV) and their off-axis resolution deteriorates rapidly. They also produce overlapping spectral images of extended sources. The instrument of choice for diffuse sources has a flat Bragg crystal located ahead of the telescope. As an example of its performance, a source emitting OVII with surface brightness = 100 photons/sqcm/sec/ster is detected in 7.8x7.8 arcmin pixels over a 2 deg radius FOV. A total observation of 300,000 sec maps the source in each of the three OVII helium-like emission lines with a spectral resolution > 600. Author (ESA)

N86-22503# Mullard Space Science Lab., Dorking (England).
THE PENNING GAS IMAGER IN A SPACE APPLICATION c35
Hugo E. Schwarz *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 287-290 refs Sponsored by UK Science and Engineering Research Council (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

The prototype Penning Gas Imager PGI(1) and its principles of operation are described. Data taken with laboratory detectors and the space version of the PGI are described. This 120 mm detector will be flown as a focal plane imager on the soft X-ray Telescope (SXT), an objective grating spectrometer. A background rejection scheme is discussed and experimental data obtained in the laboratory are presented. Application of the PGI to ESA's X-ray Multi Mirror mission is considered. Author (ESA)

N86-22504# Mullard Space Science Lab., Dorking (England).
X-RAY APPLICATIONS OF DEEP-DEPLETION CCDS c76
D. M. Walton, J. L. Culhane, R. A. Stern (Lockheed Aircraft Corp., Palo Alto, Calif.), and R. C. Catura *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 291-295 refs Sponsored by UK Science and Engineering Research Council and Lockheed Independent Research Program (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

Results demonstrating the successful use of deep-depletion CCDs as single photon X-ray detectors are presented. As focal plane X-ray detectors for X-ray astronomy, CCDs offer high spatial resolution combined with good energy resolution. The importance of deep-depletion CCDs is a significantly higher X-ray quantum efficiency (QE) than that of conventional CCDs. The measured QE for a 56 micron deep CCD manufactured from 4000 ohm-cm Si is 76% at 6 keV, over 3 times that of a conventional (10 micrometer 10 ohm-cm) CCD. The spatial resolution and energy resolution are comparable with conventional CCDs. A further advantage of deep-depletion CCDs is that cosmic rays deposit 15keV in a deep-depletion CCD allowing 90% of cosmic ray events to be rejected using energy discrimination. The application of CCDs to an X-ray astronomy mission such as XMM is described. Author (ESA)

N86-22505# Leicester Univ. (England).
X-RAY IMAGING SPECTROSCOPY WITH CCDS c76
A. Wells, D. Lumb, and R. Willingale *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 297-302 refs Sponsored by UK Science and Engineering Research Council and Lockheed Independent Research Program (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

A high sensitivity broad band spectrometer operating in the energy band 1 to 10 keV for an ESA X ray spectroscopy mission is described. The detector system, based on a CCD imager, offers spectral resolution comparable with solid state Si(Li) detectors but with spatial resolution matched to the telescope, allowing simultaneous mapping of extended sources and discrimination between point sources in crowded fields. In results from EEV/GEC CCDs, and energy resolution of 150 eV at 5.9 keV is obtained with a P 8607 device, while the experimental high resistivity device P 8600-HR has an energy resolution of 245 eV combined with a quantum efficiency of 70% at 5.9 keV. The results are substantial advances over state-of-the-art X-ray imaging CCD's. Author (ESA)

N86-22506# Department of the Air Force, Washington, D.C.
SYNTHETIC APERTURE MULTI-TELESCOPE TRACKER APPARATUS Patent Application
Carreras, inventor (to Air Force) Filed 10 Jun. 1985 34 p (AD-D011981; US-Patent-Appl-SN-734338) Avail: NTIS HC A03/MF A01 CSCL 20/6

A plurality of telescopes provide output return signals which are applied both directly and in sampled form to a photo-detector cell. The detected signals from the photo-detector will represent the constant and transient errors of the telescope system. A low pass filter insures that the tracker provides only the constant or D.C. component of the error, while a high pass filter insures that the existing measuring devices for each telescope beam provide only the transient or A.C. component of the error. The A.C. and D.C. error signals are summed together with the appropriate applied gains on each channel such that the sum reconstructs the original telescope position error with good fidelity. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-22507*# National Aeronautics and Space Administration, Washington, D.C.
METEORITE CRATERS
B. A. Ivanov and A. T. Bazilevskiy Feb. 1986 26 p refs Transl. into ENGLISH from Priroda (USSR), no. 10, 1985 p 23-35 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-4005)
(NASA-TM-78013; NAS 1.15:78013) Avail: NTIS HC A03/MF A01 CSCL 03B

The origin and formation of various types of craters, both on the Earth and on other planetary bodies, are discussed. Various models are utilized to depict various potential causes of the types and forms of meteorite craters in our solar system, and the geological structures are also discussed. Author

N86-22508*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ARCHIVE OF OBSERVATIONS OF PERIODIC COMET CROMMELIN MADE DURING ITS 1983-84 APPARITION
Z. Sekanina, ed. and M. Aronsson 15 Dec. 1985 259 p
(Contract NAS7-918)
(NASA-CR-176650; JPL-PUB-86-2; NAS 1.26:176650) Avail: NTIS HC A12/MF A01 CSCL 03B

This is an archive of 680 reduced observations of Periodic Comet Crommelin made during its 1984 apparition. The archive integrates reports by members of the eight networks of the International Halley Watch (IHW) and presents the results of a trial run designed to test the preparedness of the IHW organization for the current apparition of Periodic Comet Halley. Author

N86-22509# California Univ., San Diego. Dept. of Electrical Engineering and Computer Sciences.
USE OF INTERPLANETARY SCINTILLATION FOR EARTH SPACE ENVIRONMENT AND GEOMAGNETIC FORECASTING Final Report, 16 Nov. 1981 - 30 Apr. 1985
B. V. Jackson and B. J. Rickett Apr. 1985 50 p
(Contract F19628-82-K-0015)
(AD-A161621; AFGL-TR-85-0124) Avail: NTIS HC A03/MF A01 CSCL 03/2

A comparison is presented between solar wind velocities determined from IPS (Interplanetary Scintillation) observations made from 1973 to 1981 with those measured in situ by spacecraft instruments. The IPS method is indirect but it provides reasonably accurate estimates of the large scale and slowly varying velocity structures in the solar wind. Thus the corotating solar wind streams typical of 1973 to 1975 (declining and low solar activity) are well estimated; the slower average speed typical of 1979 to 1981 was also well estimated. However, the transient increases during this period of high solar activity were often not detected. The difficulties of interpretation are offset by the capacity to monitor the solar wind speed out of the ecliptic and over long periods of the time without the expense of a spacecraft. GRA

N86-22468# Observatoire de Besancon (France).
ACCRETING NEUTRON STARS IN CLOSE BINARY SYSTEMS
Sergio A. Ilovaisky *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 49-58 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22469# Osservatorio Astronomico, Palermo (Italy),
STELLAR ACTIVITY: THE X-RAY PICTURE
S. Serio *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 59-67 refs Sponsored by Italian Ministry for Public Education (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

N86-22478# Kapteyn Astronomical Lab., Roden (Netherlands).
A RELATIVISTIC ROTATING MASSIVE OBJECT WITH SATURATION OF MAGNETIC MONOPOLES
Qiuhe Peng *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 127-128 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N86-22510*# Lunar and Planetary Inst., Houston, Tex.
PAPERS PRESENTED TO THE WORKSHOP ON THE GEOLOGY AND PETROLOGY OF THE APOLLO 15 LANDING SITE
1985 80 p refs Workshop held in Houston, Tex., 13-15 Nov. 1985
(NASA-CR-176622; NAS 1.26:176622; LPI-Contrib-581) Avail: NTIS HC A05/MF A01 CSCL 03B

Samples from Apollo 15 flight were analyzed to develop models for lunar basin formation and evolution, basin geology, petrology, volcanology, stratigraphy, and geochemistry. For individual titles, see N86-22511 through N86-22530.

N86-22511*# Indiana Univ., Bloomington. Dept. of Geology.
REGOLITH EROSION AND REGOLITH MIXING AT THE APOLLO 15 SITE ON THE MOON
Abhijit Basu *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 1-3 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Regolith samples from the Apollo 15 landing site were used to trace soil mixing. Mixing model calculations were performed on the chemical compositions of soils from different stations. The model was constructed using modal abundance data on crystalline fragments and green glass spherules. B.G.

N86-22512*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 15 MARE UNITS AND THEIR PETROGENESIS
A. A. Binder *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 4-6 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Samples from 12 different mare sites were identified and classified among the Apollo 15 samples. The genesis of the Apollo 15 mare units is summarized given the general model of mare basalt source regions and of more basalt genesis derived from a synthesis of the major oxide/major mineral, compatible siderophile, and incompatible trace element data and isotopic ratios of the Rb/Sr and Sm/Nd systems. B.G.

N86-22513*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COMPARISON OF PETROLOGY, GRAIN SIZES AND SURFACE MATURITY PARAMETERS FOR APOLLO 15 REGOLITH BRECCIAS AND SOILS
D. D. Bogard, D. S. McKay, R. V. Morris, P. Johnson (Northrup Services, Inc.), and S. J. Wentworth (Lockheed/LEMSCO) *In* Lunar and Planetary Inst. Papers Presented to the Workshop on tyhe Geology and Petrology of the Apollo 15 Landing Site 1985 p 7-9 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

A total of 28 Apollo 15 regolith breccias were analyzed for their petrographic and textural properties and for the surface exposure indices solar noble gases and I (sub s)/Fe 0. Similarities and differences in compositional components and irradiation history were examined between regolith breccias and local, present day soils. B.G.

N86-22514*# Houston Univ., Tex.
EXTRACTION OF INFORMATION FROM MAJOR ELEMENT CHEMICAL ANALYSES OF LUNAR BASALTS
J. C. Butler *In* Lunar and Planetary Inst. Papers Presented to

the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 10-12 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Major element chemical analyses often form the framework within which similarities and differences of analyzed specimens are noted and used to propose or devise models. When percentages are formed the ratios of pairs of components are preserved whereas many familiar statistical and geometrical descriptors are likely to exhibit major changes. This ratio preserving aspect forms the basis for a proposed framework. An analysis of compositional variability within the data set of 42 major element analyses of lunar reference samples was selected to investigate this proposal. B.G.

N86-22515*# State Univ. of New York, Albany. Dept. of Geological Science.
APOLLO 15 MARE VOLCANISM: CONSTRAINTS AND PROBLEMS
J. W. Delano *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 13-17 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The Apollo 15 landing site contains more volcanics in the form of crystalline basalts and pristine glasses, which form the framework for all models dealing with the mantle beneath that site. Major issues on the petrology of the mare source regions beneath that portion of Mare Imbrium are summarized. Author

N86-22516*# Arizona State Univ., Tempe. Dept. of Geology.
HADLEY RILLE, LAVA TUBES AND MARE VOLCANISM AT THE APOLLO 15 SITE
Ronald Greeley and Paul D. Spudis (Geological Survey, Flagstaff, Ariz.) *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 18-21 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Hadley Rille appears to be a collapsed lava tube/channel, whose formation history may be more intimately related to the mare units sampled at 15 than was previously thought. More work is needed relating samples and observations from Apollo 15 to the rille and its geologic evolution. As the only sinuous rille visited during the Apollo missions, Hadley Rille represents a data source that is directly applicable to the deciphering of processes involved in lunar mare volcanism. Author

N86-22517*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetary Sciences.
THE GEOLOGIC HISTORY OF QUARTZ-NORMATIVE AND OLIVINE-NORMATIVE BASALTS IN THE VICINITY OF HADLEY RILLE (APOLLO 15)
T. L. Grove *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 22-24 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The geologic history of the quartz normative (QNB) and olivine normative (ONB) basalt types at Hadley Rille are discussed. A model for the geology of the mare basalts was constructed from a combination of field observations, sample chemistry, sample petrology and personal bias from terrestrial experience. The model proposes that the QNBs are the only mare lava type that is present as outcrop in the area traversed by the astronauts during the Apollo 15 mission. The returned QNB samples formed during a single eruptive phase of the Hadley Rille lava tube system. The ONB lavas are an exotic component transported to the site by a cratering event, or the ONBs are samples excavated from older are bedrock that was partly covered by the QNB lavas. Author

N86-22518*# Washington Univ., St. Louis, Mo. Dept. of Earth and Planetary Sciences.
CHEMICAL COMPONENTS OF THE APOLLO 15 REGOLITH
Randy L. Korotev *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 25-29 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The lunar regolith is a complex mixture of many components. Compositional data is used to identify and estimate the relative importance of the various chemical components of the regolith. The results and conclusions of four methods that were applied to Apollo 15 regolith data were reviewed to determine the important chemical components: graphical techniques, analysis of individual soil particles, factor analysis, and multicomponent mixing models. This synthesis relies heavily on data and conclusions from the literature as well as new analyses on 28 regolith breccia samples, 28 soil samples, and 50 individual 1 to 2 mm particles from soil 15272. Author

N86-22519*# Washington Univ., St. Louis, Mo. Dept. of Earth and Planetary Sciences.
PETROLOGY AND GEOCHEMISTRY OF HIGHLANDS SAMPLES FROM THE APENNINE FRONT
Marilyn M. Lindstrom *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 30-34 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Individual rocks from the Hadley Delta massif, part of the Apennine Front, are described beginning with the simplest samples to the most complex breccias. Relationship among the samples were evaluated. Geological interpretations of the samples were speculative because of the limited data set, but provided models to be tested when additional data are available. B.G.

N86-22520*# Yale Univ., New Haven, Conn.
ULTRAMAFIC PARENT MAGMAS FOR MARE BASALTS?
J. Longhi *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 35-37 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Solidification products of basaltic magmas (fine grained basalts and ultramafic glasses) at the Apollo 15 site were examined. Consideration of simple MgO-6IO2-Al2O3 systematics plus results of calculations of fractional crystallization was reviewed. Suggestions are presented to account for the lack of correlation between the ultramafic glasses and basalts. B.G.

N86-22521*# Hawaii Univ., Honolulu. Planetary Geoscience Div.
SPECTRAL REFLECTANCE STUDY OF THE HADLEY-APPENINE (APOLLO 15) REGION
P. G. Lucey and B. R. Hawke *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 38-40 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Twenty-three near infrared spectra were obtained from the Mauna Kea Observatory 2.2 m telescope. Results of an analysis of near infrared spectra obtained for surface units in the Hadley-Apennine region were presented. Compositional trends from the interior to exterior of the Imbrium are discussed. B.G.

N86-22522*# Lunar and Planetary Inst., Houston, Tex.
SAMPLES AT THE APOLLO 15 LANDING SITE: TYPES AND DISTRIBUTION
Graham Ryder *In its* Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 41-45 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Samples, consisting of more than 350 individually numbered samples of rock and regolith, were collected during the three EVAs on the Apollo 15 mission. Samples consisted of rock specimens,

and scooped, trenched, and cored regolith samples. Petrographic and chemical analysis are discussed. B.G.

N86-22523*# Tennessee Univ., Knoxville. Dept. of Geological Sciences.
APOLLO 15 MARE BASALTS: A DIVERSE SUITE OR TWO DISTINCT GROUPS?
Peter A. Salpas and Lawrence A. Taylor *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 46-48 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The literature geochemical data for 60 Apollo 15 mare basalts were compiled in order to evaluate possible intra-group relationships of the Apollo 15 mare basalts. The effects of olivine or pigeonite fractionation were discussed. Models were developed to explain the trace element characteristics of the samples. B.G.

N86-22524*# South Dakota School of Mines and Technology, Rapid City. Inst. for the Study of Mineral Deposits.
APOLLO 15 REGOLITH BRECCIAS AND SOILS: COMPARATIVE PETROLOGY AND CHEMISTRY
S. B. Simon, J. J. Papike (Battelle, Richland, Wash.), and J. C. Laul *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 49-51 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Soils and regolith breccias contain clues to the geologic processes that contributed to the evolution of the local regolith over time. A suite of ten regolith breccias from the Apollo 15 site were compared with the results of previous studies in order to learn more about the regolith evolution at that site. Author

N86-22525*# Geological Survey, Flagstaff, Ariz.
THE MATERIALS AND FORMATION OF THE IMBRIUM BASIN
Paul D. Spudis *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 52-56 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The deposits around the Imbrium basin form a widespread stratigraphic datum, to which other lunar geological units may be relatively dated. More importantly, as a relatively well preserved multi-ring basin, Imbrium provides an important target of geologic investigation to study the processes involved in lunar basin formation and evolution. Two Apollo missions (Apollo 14 and 15) were send to landing sites chosen specifically to address problems of the Imbrium basin geology. Data about the deposits of the Imbrium basin are reviewed. Formational mechanics of lunar basins in general and the relations of materials collected at the highlands adjacent to the Apollo 15 landing site to Imbrium and other basins are examined. Author

N86-22526*# Geological Survey, Flagstaff, Ariz.
THE APENNINE BENCH FORMATION REVISITED
P. D. Spudis and B. R. Hawke (Hawaii Univ., Honolulu) *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 57-59 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The Apennine Bench Formation consists of pre-mare light plains materials that crop out south of the crater Archimedes, inside the Imbrium basin. This material was ascribed to either impact or volcanic origins. The characteristics of Apollo 15 KREEP basalts and the Apennine Bench Formation are reviewed to determine whether their characteristics are compatible with a volcanic origin. Author

N86-22527*# Geological Survey, Flagstaff, Ariz.
SOME OBSERVATIONS ON THE GEOLOGY OF THE APOLLO 15 LANDING SITE
G. A. Swann *In* Lunar and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 60-64 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

High resolution (panoramic) and high geometric fidelity (metric) photos were taken from orbit of the lunar landing sites. Gamma ray and X-ray fluorescence spectroscopic measurement were taken to determine regional chemical composition of the Moon. Distinctive features of the Apennine Bench Formation are described. The structurally controlled topography of the Apennine Bench Formation is suggested of a lava channel or collapsed lava tube. B.G.

N86-22528*# California Univ., Los Angeles. Inst. of Geophysics.
THE ORIGIN OF PRISTINE KREEP: EFFECTS OF MIXING BETWEEN ur KREEP AND THE MAGMAS PARENTAL TO THE MG-RICH CUMULATES
Paul H. Warren *In* Lunary and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 65-67 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

The magnesium/incompatible elements paradox is explained by a model that considers not only the magmasphere, but also its aftermath. A systematic mixing of primitive magnesium rich material with residual liquid is discussed as a method to account for the paradox that KREEP basalts, despite their high incompatible element contents, have moderate magnesium ratios. The KREEP basalts are compared with mare basalts. B.G.

N86-22529*# Geological Survey, Menlo Park, Calif.
GEOLOGIC SETTING OF THE APOLLO 15 LANDING SITE
D. E. Wilhelms *In* Lunary and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 68-72 refs (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Returned Apollo 15 samples were used to provide a remarkably comprehensive sampling of the Moon's profile and geologic history. The geological structure of the Apennine Bench Formation is described. The large collection of pigeonite and olivine basalts from the landing sites were viewed in the context of the site's geology. B.G.

N86-22530*# Geological Survey, Menlo Park, Calif.
SELECTION OF THE APOLLO 15 LANDING SITE
D. E. Wilhelms *In* Lunary and Planetary Inst. Papers Presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site 1985 p 73-75 (For primary document see N86-22510 12-91)
Avail: NTIS HC A05/MF A01 CSCL 03B

Telescopic studies in the early 1960's pinpointed the future Apollo 15 landing site as a potential exploration site because it included one of the largest lunar sinuous rilles, Rima Hadley, and some of the highest mountains, Montes Apenninus. Additional targets were identified once Apennine-Hadley emerged as a potential landing site. Site selection processes were discussed. B.G.

N86-22531*# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
VOYAGER SATURNIAN RING MEASUREMENTS AND THE EARLY HISTORY OF THE SOLAR SYSTEM
H. Alfven, I. Axnaes, N. Brenning, and P.-A. Lindquist Jul. 1985 31 p refs Sponsored by NASA, NSF and Swedish Natural Science Research Council
(NASA-CR-176638; NAS 1.26:176638; TRITA-EPP-85-07; ISSN-0348-7539) Avail: NTIS HC A03/MF A01 CSCL 03B

The mass distribution in the Saturnian ring system is investigated and compared with predictions from plasma cosmogony. According to this theory, the matter in the rings was once a magnetized plasma, in which gravitation is balanced by the centrifugal and electromagnetic forces. As the plasma is neutra-

lized, the electromagnetic forces disappear and the matter falls in to 2/3 of the original saturnocentric distance. This causes the cosmogonic shadow effect, demonstrated for the large scale structure of the Saturnian ring system. It is shown that many structures of the present ring system can be understood as shadows and antishadows of cosmogonic origin. These appear in the form of double rings centered around a position a factor 0.64 (slightly < 2/3) closer to Saturn than the causing feature. Voyager data agree with an accuracy > 1%. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-22532 California Inst. of Tech., Pasadena.
SOLAR PHOTOSPHERIC AND CORONAL ABUNDANCES FROM SOLAR ENERGETIC PARTICLE MEASUREMENTS Ph.D. Thesis
H. Herbert Breneman 1985 178 p
Avail: Univ. Microfilms Order No. DA8522605

Observations fo solar energetic particles (SEPs) from 22 solar flares in the 1977 to 1982 time period are reported. The observations were made by the Cosmic Ray Subsystem on board the Voyager 1 and 2 spacecraft. SEP abundances have been obtained for all elements with 3 < or Z < or = 30 except Li, Be, B, F, Sc, V, Co and Cu, for which upper limits have been obtained. Statistically meaningful abundances of several rare elements (e.g., P, Cl, K, Ti, Mn) have been determined for the first time, and the average abundances of the more abundant elements have been determined with improved precision, typically a factor of three better than the best previous determinations. Previously reported results concerning the dependence of the fractionation of SEPs relative to photosphere on first ionization potential (FIP) have been confirmed and amplified upon with the new data. The monotonic Z-dependence of the variation between flares noted by earlier studies was found to be interpretable as a fractionation, produced by acceleration of the particles from the corona and their propagation through interplanetary space, which is ordered by the ionic charge-to-mass ratio Q/M of the species making up the SEPs. Dissert. Abstr.

N86-22533 Institut d'Aeronomie Spatiale de Belgique, Brussels.
A COMPUTER SIMULATION STUDY OF THE MICROSCOPIC STRUCTURE OF A TYPICAL CURRENT SHEET IN THE SOLAR WIND
M. A. Roth 1985 17 p refs Presented at 19th ESLAB Symposium on the Sun and the Heliosphere in Three Dimensions, Les Diablerets, Switzerland., 4-6 Jun. 1985 Submitted for publication (Aeronomica-Acta-A-301-1985) Avail: Issuing Activity

It is shown that the internal structure of a typical current sheet in the solar wind can be simulated numerically by a computer program based on the Vlasov theory of tangential discontinuities in collisionless plasma with multiple species. For each plasma species, moments of the velocity distribution function up to the third order were computed and are illustrated, together with the magnetic field, the electric potential, the electric field, and the charge density. It is shown that the thickness of the current layer is 20 proton gyro-radii. This means that, in order to resolve such layers, the time resolution of plasma measurements should not exceed 1sec. Author (ESA)

N86-22534*# Illinois Univ., Urbana. Aeronomy Lab.
SOLAR FLARE IONIZATION IN THE MESOSPHERE OBSERVED BY COHERENT-SCATTER RADAR
J. W. Parker and S. A. Bowhill 1 Jan. 1986 128 p refs
(Grants NsG-7506; NSF ATM-81-20371)
(NASA-CR-176649; NAS 1.26:176649; AR-118; ISSN-0568-0581; UILU-ENG-86-2501) Avail: NTIS HC A07/MF A01 CSCL 03B

The coherent-scatter technique, as used with the Urbana radar, is able to measure relative changes in electron density at one altitude during the progress of a solar flare when that altitude contains a statistically steady turbulent layer. This work describes the analysis of Urbana coherent-scatter data from the times of 13 solar flares in the period from 1978 to 1983. Previous methods of measuring electron density changes in the D-region are summarized. Models of X-ray spectra, photoionization rates, and ion-recombination reaction schemes are reviewed. The coherent-scatter technique is briefly described, and a model is developed which relates changes in scattered power to changes in electron density. An analysis technique is developed using X-ray flux data from geostationary satellites and coherent scatter data from the Urbana radar which empirically distinguishes between proposed D-region ion-chemical schemes, and estimates the nonflare ion-pair production rate. Author

N86-22535# Alaska Univ., Fairbanks. Geophysical Inst.
DEVELOPMENT OF A GEOMAGNETIC STORM PREDICTION SCHEME Final Report, 23 Feb. 1982 - 23 Apr. 1985
S. I. Akasofu and C. F. Fry Jun. 1985 40 p
(Contract F19628-82-K-0035)
(AD-A161651; AFGL-TR-85-0152) Avail: NTIS HC A03/MF A01 CSCL 08/14

Since present geomagnetic storm prediction schemes rely entirely on statistical results, so that they can't provide quantitative information on the intensity of a geomagnetic storm caused by a particular solar event, a first generation numerical prediction scheme. The scheme consists of two major computer codes which consist of a large number of subroutine codes and of empirical relationships. When a solar flare occurs, six flare parameters are determined as the input data set for the first code which is devised to show the simulated propagation of solar wind disturbances in the heliosphere to a distance of 2 AU. Thus, one can determine the relative location of the propagating disturbances with the earth's position. The solar wind speed and the three interplanetary magnetic field (IMF) components are then computed as a function of time at the Earth's location or any other desired (space probe) locations. These quantities become the input parameters for the second major code which computes the power of the solar wind-magnetosphere dynamo as a function of time. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

N86-22536# Pennsylvania Univ., Philadelphia. Dept. of Physics.
SEARCH FOR MAGNETIC MONOPOLES, NEUTRINO OSCILLATIONS, AND SUPERHIGH ENERGY PARTICLES Technical Progress Report
K. Lande Oct. 1985 22 p
(Contract DE-AC02-81ER-40012)
(DE86-001548; DOE/ER-40012/01) Avail: NTIS HC A02/MF A01

The deep underground Large Area Scintillation Detector and surface air shower array at the Homestake Gold Mine are now in operation. Beginning in January 1985, the underground detector has been searching for muons from Cygnus X-3; the surface-underground telescope has been collecting cosmic ray data since the Spring of 1985. We describe these data, and discuss the experiments to search for magnetic monopoles, neutrinos, and high energy cosmic ray air showers with these instruments and with a new atmospheric Cerenkov detector. There are three elements in the Homestake detector: a deep underground 140-ton Large Area liquid Scintillation Detector (LASD), an extensive air shower array located on the surface above the underground detector, and a Cerenkov telescope to view cosmic ray primary interactions in the upper atmosphere. The combined Large Area Scintillation Detector - Air Shower Array - Cerenkov Detector system

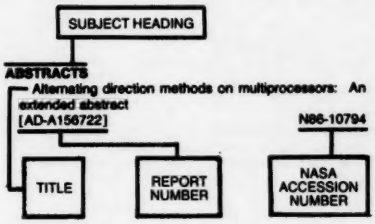
is designed to: (1) search for massive magnetic monopoles; (2) measure the flux of high energy neutrinos, search for sources of these neutrinos, and look for neutrino oscillations; (3) measure the composition of very high energy cosmic rays; (4) search for and investigate the nature of the surface and underground flux from Cygnus X-3 and other binary pulsars; and (5) look for neutrino bursts from collapsing stars. DOE

N86-22463# Cambridge Univ. (England). Inst. of Astronomy.
THE X-RAY BACKGROUND
Paul Guilbert *In* ESA Proceedings of ESA Workshop on a Cosmic X-Ray Spectroscopy Mission Sep. 1985 p 15-18 refs (For primary document see N86-22461 12-89)
Avail: NTIS HC A14/MF A01

99 GENERAL

No abstracts in this category.

Typical Subject Index Listing



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A

ABLATIVE MATERIALS
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512

ABRASION
Crack initiation and microstructure in tungsten carbide-cobalt composites N86-21651
A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653

ABRASIVES
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573

ABSORBERS (EQUIPMENT)
Structural damping potential of waveguide absorbers N86-21907

ABSORBERS (MATERIALS)
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692

ABSORPTANCE
Comparative accuracy of the Albedo, transmission and absorption for selected radiative transfer approximations
[NASA-RP-1160] N86-22022

ABSORPTION CROSS SECTIONS
Radiative neutron capture by deuterum N86-22325

ABSORPTION SPECTRA
Radiative interactions in transient energy transfer in gaseous systems
[NASA-CR-176644] N86-21798
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses
[NASA-TM-77903] N86-21841
Semiconductor laser source for natural gas leak detection
[PB86-102811] N86-21849
Particulate models of photosynthesis
[DE86-001625] N86-22090

ABSORPTION SPECTROSCOPY
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343

ABSTRACTS
Extended abstracts, 36th International Society of Electrochemistry held at Salamanca, Spain on 23-28 September 1985
[AD-A162434] N86-21644

ACCELERATION (PHYSICS)
Test fixture effects in vibration tests of rocket motors
[AD-A161403] N86-21581
Structural loads preliminary results N86-21940
Digital filtering and acceleration pulse interpretation N86-21941
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380

ACCELERATION TOLERANCE
NASA seat experiment and occupant responses N86-21939
Impact dynamics instrumentation N86-21948

ACCELEROMETERS
NASA experiments on the B-720 structure and seats N86-21936
Digital filtering and acceleration pulse interpretation N86-21941
Impact dynamics instrumentation N86-21948

ACCESS CONTROL
View based, global design of access structures for relational databases N86-22144
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236

ACCOUNTING
A guide to promote the use of electronic spreadsheets among Air Force personnel
[AD-A161682] N86-22164

ACCURACY
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
Relative accuracy of ALPEX aircraft data: An evaluation of the ALPEX intercomparison flight with the NCAR (National Center for Atmospheric Research) Electra, the NOAA (National Oceanic and Atmospheric Administration P3 and the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft-und Raumfahrt) Falcon
[PB86-100823] N86-22067

ACETONE
Complexes of nitrocellulose with cupric chloride
[AD-A162519] N86-21589

ACETYL COMPOUNDS
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356

ACETYLENE
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N86-21685

ACID RAIN
Operating research plan. Volume 2: Inventory of research under the National Acid Precipitation Assessment Program
[DE86-001593] N86-22007
National acid precipitation assessment program emission inventory allocation factors
[PB86-104247] N86-22010
Quality assurance for the acid precipitation measurement program in the US
[PB86-107034] N86-22011
Characterization of reactants, reaction mechanisms and reaction products in atmospheric water droplets: Fog, cloud, dew and rain water chemistry
[PB86-107976] N86-22017
NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054

ACIDOSIS
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100

ACOUSTIC FATIGUE
Measured damping of shuttle acoustic test structures N86-21905
Laminated damped fuselage structures N86-21916

ACOUSTIC FREQUENCIES
Studies of acoustic effects on a flow boundary layer in air
[NASA-TM-77981] N86-21792

ACOUSTIC LEVITATION
Containerless high purity pulling process and apparatus for glass fiber
[NASA-CASE-MFS-25905-2] N86-21718

ACOUSTIC MEASUREMENT
Measured damping of shuttle acoustic test structures N86-21905
Studies of complex-terrain flows using acoustic remote sensors
[PB86-100138] N86-22068

ACOUSTIC MICROSCOPES
High resolution acoustic microscopy N86-22301

ACOUSTIC PROPAGATION
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255

ACOUSTIC PROPERTIES
An analysis for the sound field produced by rigid wide cord dual rotation propellers of high solidarity in compressible flow
[NASA-TM-87178] N86-21517
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307

ACOUSTIC SCATTERING
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310

ACOUSTIC VELOCITY
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas
[IPPJ-751] N86-22402

ACOUSTICS
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255

ACOUSTO-OPTICS
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
Optical acquisition, image and data compression
[AD-A161650] N86-22393

ACQUISITION
Initial and qualification operational test and evaluation in the acquisition of non-major communication systems
[AD-A161729] N86-22439

ACRYLONITRILES
Photodissociation of vinyl cyanide N86-22355

ACTINIDE SERIES
Superconductivity in the actinides
[DE86-000786] N86-22433

ACTINIDE SERIES COMPOUNDS
Superconductivity in the actinides
[DE86-000786] N86-22433

ACTIVATION
Lymphocyte activation - regulatory substances
[AD-A162683] N86-22087

ACTIVATION ENERGY
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
Study of mechanisms of ionic transport in crystalline and glassy solid electrolytes N86-21976

ACTIVE CONTROL
Quasi-modal vibration control by means of active control bearings
[NASA-TM-87232] N86-21856
Passive and Active Control Of Space Structures (PACOSS) N86-21931

ACTUATORS
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113

ACUITY
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311

ADA (PROGRAMMING LANGUAGE)
A graphical debugger for concurrent Ada programs N86-22147
CWI Newsletter, no. 6, March 1985
[CWI-NEWSLETTER-6] N86-22154
Mathematical libraries in Ada N86-22156
Ada reusability guidelines
[AD-A161259] N86-22157
An assessment of Ada's suitability in general purpose programming applications
[AD-A161715] N86-22165

ADAPTATION
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102

ADAPTIVE CONTROL
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865
Robust adaptive control
[AD-A161349] N86-22192
On a theory of control for linear systems over rings and nonlinear/time-varying systems
[AD-A162680] N86-22194
Adaptive control of multivariable systems
[AD-A162795] N86-22195
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231

ADDITIVES
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344

ADHESION
Polyimide and the polymer-metal interaction N86-22346

ADHESIVE BONDING
Finite-element analysis of adhesively bonded joints
[PB86-100708] N86-21869

ADHESIVES
Aminophenoxycyclotriphosphazene cured epoxy resins and the composites, laminates and structures thereof
[NASA-CASE-ARC-11548-1] N86-21686
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000

ADIABATIC CONDITIONS
Heat release effects in a turbulent, reacting shear layer N86-21788

ADSORPTION
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
A solvable model for localized adsorption in a Coulomb system
[AD-A162697] N86-21776
The adsorption of carbon monoxide on palladium films N86-22340
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428

AERIAL PHOTOGRAPHY
Installing a copy of the ARPA/DMA image understanding testbed at the US Army Engineer Topographic Laboratories
[AD-A158394] N86-21818

AEROACOUSTICS
Aeroacoustics of contoured and solid/porous conical plug-nozzle supersonic jet flows
[NASA-CR-176645] N86-22308

AERODYNAMIC CHARACTERISTICS
Vortical flows about oscillating airfoil with surface suction N86-21502
Losses in channels with increased internal turbulence
[NASA-TM-77995] N86-21515
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
Concepts and effects of damping in isolators N86-21891
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

AERODYNAMIC COEFFICIENTS
Theory of wing rock
[NASA-CR-176640] N86-21520
Measurements of the symmetric aerodynamic coefficients for flat faced cylinders with strakes in the angle of attack regime 70 to 90 deg for transonic speed
[FFA-TN-1985-39] N86-21523

AERODYNAMIC CONFIGURATIONS
Comparison of computational results of a few representative three-dimensional transonic potential flow analysis programs
[NASA-TM-77963] N86-21509
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549

AERODYNAMIC DRAG
Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519

AERODYNAMIC HEATING
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

AERODYNAMIC STABILITY
Theory of wing rock
[NASA-CR-176640] N86-21520
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536
A comparison of measured spacecraft modal damping values N86-21903

AERODYNAMIC STALLING
Computation of three dimensional potential flow around a finite wing with a leading-edge discontinuity at high angle of attack N86-21504
Effects of wing modification on an aircraft's aerodynamic parameters as determined from flight data
[NASA-TM-87591] N86-21550

AERODYNAMICS
Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827

AEROELASTICITY
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552

AEROLOGY
Inventory of research grade air monitoring stations operated by European research groups
[AP-25] N86-22009

AERONOMY
Proceedings of the 12th Annual Meeting on Atmospheric Studies by Optical Methods
[AP-23] N86-22027
Experimental and theoretical information on radiative lifetimes and oscillator strengths --- aeronomy N86-22037
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043

AEROSOLS
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
Characterization of reactants, reaction mechanisms and reaction products in atmospheric water droplets: Fog, cloud, dew and rain water chemistry
[PB86-107976] N86-22017
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046

AEROSPACE ENGINEERING
Japan report: Science and technology
[JPRS-JST-86-001] N86-21723
Some musings on how to make damping a creative force in design N86-21884

AEROSPACE ENVIRONMENTS
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
Fabricate, calibrate and test a dosimeter for integration into the CRRES (Combined Release and Radiation Effects Satellite)
[AD-A161695] N86-21825

AEROSPACE INDUSTRY
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623

AEROSPACE MEDICINE
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 282)
[NASA-SP-7011(282)] N86-22093
The history of aeronautical medicine in Venezuela
[NASA-TM-77709] N86-22094

AEROSPACE SYSTEMS
Norwegian aerospace activities: An overview
[NASA-TM-77711] N86-21562

AEROTHERMOCHEMISTRY
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air N86-21632
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction
[NASA-TM-78001] N86-21791

AFTERBURNING
High frequency-heated air turbojet
[NASA-TM-77710] N86-21543

AFTERGLOWS
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043

AGING (MATERIALS)
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
Application of hydrogen analysis to the compatibility testing and long-term aging of explosives
[DE86-001689] N86-21713
The aging correlation (RH + t): Relative humidity (%) + temperature (deg C)
[NASA-CR-176661] N86-21980

AGING (METALLURGY)
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21663

AGRICULTURAL AIRCRAFT
Vertically operating flight vehicle for drilling and agricultural use
[NASA-TM-77713] N86-21535

AIR FLOW
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction
[NASA-TM-78001] N86-21791
Air mass modification in the marginal ice zone
[AD-A161745] N86-22062

AIR INTAKES
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
AIR MASSES
Air mass modification in the marginal ice zone
[AD-A161745] N86-22062
AIR POLLUTION
Characterization of emission rates from indoor combustion sources
[PB86-103900] N86-21874
Operating research plan. Volume 2: Inventory of research under the National Acid Precipitation Assessment Program
[DE86-001593] N86-22007
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center — research reactor
[OEFZS-4324] N86-22008
Green River air quality model development. VALMET: A valley air pollution model
[PB86-104106] N86-22013
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015
AIR QUALITY
Characterization of emission rates from indoor combustion sources
[PB86-103900] N86-21874
Inventory of research grade air monitoring stations operated by European research groups
[AP-25] N86-22009
Green River air quality model development. VALMET: A valley air pollution model
[PB86-104106] N86-22013
User's guide for the multiple airshed (MASH) model
[PB86-100146] N86-22014
NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054
AIR SEA ICE INTERACTIONS
Air mass modification in the marginal ice zone
[AD-A161745] N86-22062
AIR TRAFFIC
Activities report of the aerospace industry in West Germany
[ISSN-0176-5086] N86-22450
AIR WATER INTERACTIONS
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22081
AIRCRAFT ACCIDENT INVESTIGATION
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525
Aircraft accident report: Galaxy Airlines, Inc., Lockheed Electra-L-188C, N5532, Reno, Nevada, January 21, 1985
[PB86-910401] N86-21526
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528
AIRCRAFT ACCIDENTS
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
CID overview N86-21934
CID flight/impact N86-21935
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
Data reduction, management, and analysis software for CID N86-21938
NASA seat experiment and occupant responses N86-21939
Structural loads preliminary results N86-21940
Digital filtering and acceleration pulse interpretation N86-21941
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
AIRCRAFT COMPARTMENTS
Proceedings of Cabin Safety Conference and Workshop held on 11-14 December 1984
[AD-A160950] N86-21527
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
AIRCRAFT CONFIGURATIONS
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
AIRCRAFT CONSTRUCTION MATERIALS
Structural materials in aeronautics: Prospects and perspectives
[RAE-TR-85077] N86-21532
NASA experiments on the B-720 structure and seats N86-21936
AIRCRAFT CONTROL
Propulsion and control propellers with thruster nozzles primarily for aircraft applications
[NASA-TM-77715] N86-21511
AIRCRAFT DESIGN
Comparison of computational results of a few representative three-dimensional transonic potential flow analysis programs
[NASA-TM-77963] N86-21509
Three-dimensional boundary layer analysis program Blay and its application
[NASA-TM-77962] N86-21516
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
AIRCRAFT ENGINES
Structural materials in aeronautics: Prospects and perspectives
[RAE-TR-85077] N86-21532
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories)
[AD-A161664] N86-21537
AIRCRAFT EQUIPMENT
Aircraft interior panel test criteria derived from full-scale fire tests
[AD-A161637] N86-21529
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
AIRCRAFT FUELS
General aviation pilot and aircraft activity survey
[AD-A161665] N86-21530
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540
Development of LC-13C NMR
[NASA-CR-176656] N86-21704
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
AIRCRAFT GUIDANCE
Algorithms for the automatic four-dimensional guidance of aircraft, taking into account the current wind situation
[ESA-TT-908] N86-21531
AIRCRAFT MAINTENANCE
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
A methodology for applying bar code technology to Aircraft Maintenance Unit support sections
[AD-A161783] N86-22441
AIRCRAFT NOISE
The role of vibration and rattle in human response to helicopter noise
[AD-A162486] N86-22110
An experimental appraisal of the use of ground-plane microphones for aircraft noise measurement — certification tests
[NPL-AC-104] N86-22302
Airport-Noise Levels and Annoyance Model (ALAMO) user's guide
[NASA-TM-87695] N86-22304
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
An evaluation of study design for estimating a time-of-day noise weighting
[NASA-CR-178062] N86-22306
Measurement of noise from airplanes traveling at heights 3500 to 6000m
[FFA-TI-AU-2168] N86-22312
AIRCRAFT POWER SUPPLIES
Controlled impact demonstration on-board (interior) photographic system N86-21946
AIRCRAFT SAFETY
Aircraft accident report: Galaxy Airlines, Inc., Lockheed Electra-L-188C, N5532, Reno, Nevada, January 21, 1985
[PB86-910401] N86-21526
Proceedings of Cabin Safety Conference and Workshop held on 11-14 December 1984
[AD-A160950] N86-21527
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528
AIRCRAFT STABILITY
Effects of wing modification on an aircraft's aerodynamic parameters as determined from flight data
[NASA-TM-87591] N86-21550
AIRCRAFT STRUCTURES
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
Aircraft interior panel test criteria derived from full-scale fire tests
[AD-A161637] N86-21529
Structural materials in aeronautics: Prospects and perspectives
[RAE-TR-85077] N86-21532
Beam dampers for skin vibration and noise reduction in the 747 N86-21917
Integrated damped fuselage structure N86-21918
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
CID overview N86-21934
NASA experiments on the B-720 structure and seats N86-21936
Structural loads preliminary results N86-21940
Preliminary floor, seat, and dummy data N86-21942
CID-720 aircraft high-environment flight instrumentation system N86-21947
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
AIRCRAFT TIRES
Rubber removal specification development
[FAA/PM-85/33] N86-21555
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
AIRFOILS
Vortical flows about oscillating airfoil with surface suction N86-21502
Computation of three dimensional potential flow around a finite wing with a leading-edge discontinuity at high angle of attack N86-21504
A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508
Turbine vane external heat transfer. Volume 1: Analytical and experimental evaluation of surface heat transfer distributions with leading edge showerhead film cooling
[NASA-CR-174827] N86-21546
Effect of a rotor wake on the local heat transfer on the forward half of a circular cylinder
[NASA-TM-87234] N86-21794
AIRFRAMES
Use of skin damping treatments to control airframe dynamic response for interior noise control N86-21919
Controlled impact demonstration airframe bending bridges N86-21943
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
AIRGLOW
Observations of airglow O2 (1 sigma) atmospheric band at 8645A and the rotational temperature at 23 S N86-22030
Atom recombination as a source of airglow N86-22036
Experimental and theoretical information on radiative lifetimes and oscillator strengths — aeronomy N86-22037
AIRLINE OPERATIONS
Activities report of the aerospace industry in West Germany
[ISSN-0176-5086] N86-22450
AIRPORT PLANNING
General aviation pilot and aircraft activity survey
[AD-A161665] N86-21530
AIRPORTS
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525
Weather radar studies
[AD-A161622] N86-22061
Airport-Noise Levels and Annoyance Model (ALAMO) user's guide
[NASA-TM-87695] N86-22304
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
ALABAMA
Research projects of the Water Resources Research Institute during FY 1983
[PB86-101235] N86-21973

ALBEDO
Comparative accuracy of the Albedo, transmission and absorption for selected radiative transfer approximations [NASA-RP-1160] N86-22022

ALGORITHMS
Algorithms for the automatic four-dimensional guidance of aircraft, taking into account the current wind situation [ESA-TT-908] N86-21531
A network flow approach to the wafer scale integration of VLSI arrays [AD-A161345] N86-21759
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits [AD-A161371] N86-21761
Planning by search through simulations [AD-A162470] N86-21864
Geometrically nonlinear analysis of shell structures using flat DKT shell elements [AD-A162729] N86-21964
Vehicle routing and computer graphics N86-22124
Special purpose computer architecture for LU factorization of partitioned systems [AD-A161351] N86-22133
Algorithms for nonlinear programming [AD-A161746] N86-22138
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor [DE86-001461] N86-22143
Clustering algorithms for hierarchical routing in networks [AD-A161372] N86-22160
Fast and efficient algorithms for linear programming and for the linear least squares problem [AD-A161391] N86-22161
Two new approximate solution techniques for a moving target problem when searcher motion is constrained [AD-A162491] N86-22171
Finding critical sets [AD-A161368] N86-22207
Complexity of the generalized mover's problem [AD-A161378] N86-22209
An adaptive mesh algorithm for solving systems of time dependent partial differential equations [AD-A161822] N86-22215
The reduction of perturbed markov generators: An algorithm exposing the role of transient states [AD-A162773] N86-22219
A Markov chain approach to electrocardiogram modeling and analysis [AD-A162776] N86-22220
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields [AD-A161334] N86-22231
Markov chains with rare transitions and simulated annealing [AD-A161598] N86-22237
On measures of nonnormality of matrices [FEW-167] N86-22253
Optical acquisition, image and data compression [AD-A161650] N86-22393

ALIGNMENT
Plane representations of graphs and visibility between parallel segments [AD-A161689] N86-21770
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358

ALKALINE EARTH OXIDES
Re-evaluation of surface properties of oxide-cathode materials [AD-A161131] N86-21687

ALKYL COMPOUNDS
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether [NASA-TM-87260] N86-21575

ALLOCATIONS
Reducing memory references via effective register usage [AD-A161352] N86-21760
Optimum allocation in multistate systems, with applications in reliability [AD-A161392] N86-22135

ALLOYS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration [AD-A161671] N86-21666
Damping behavior of metal matrix composites N86-21900
Core level shifts and electronic structure of Cu3Au N86-22334

ALLUVIUM
Ground response in alluvial basins due to seismic disturbances [AD-A162467] N86-22047

ALPHA PARTICLES
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261
Alpha-particle-driven instability of alfven waves in a tandem mirror [DE86-000741] N86-22382

ALUMINUM
Fatigue response of silicon carbide whisker/aluminum matrix composites N86-21591
Buckling of laminated composite plates and shell panels [AD-A162723] N86-21623
A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl N86-22366
Excited-state properties of semiconductor electrodes and their application to optical energy conversion [AD-A162774] N86-22432
Light weight aluminum optics --- spaceborne x-ray astronomy applications N86-22487

ALUMINUM ALLOYS
Development of an elevated temperature aluminum alloy containing Al3X-type dispersed phases N86-21650
Effect of additional heat treatment of 2024-T3 on the growth of fatigue crack in air and in vacuum [NASA-TM-77984] N86-21657
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data [AD-A161366] N86-21662
Damping in metal-matrix composites: Measurement and modeling N86-21901
The use of quantitative databases in Aladin, an alloy design system [AD-A162555] N86-22176
Photon desorption studies of synchrotron materials N86-22339

ALUMINUM COATINGS
Reflectance measurements of aluminum coatings at 200 - 500 nm N86-22351

ALUMINUM COMPOUNDS
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings [AD-A161518] N86-21956

ALUMINUM GRAPHITE COMPOSITES
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899

AMERICIUM
Robotic sample preparation for radiochemical plutonium and americium analyses [DE86-000801] N86-21868

AMINES
Prediction of detonation transition in porous explosives from rapid compression loadings [AD-A162767] N86-21711

AMORPHOUS MATERIALS
TDK affiliate develops new solar power cell N86-21726

AMPHIBOLES
Amphibole ceramics: Conceptual development and preliminary experiments [DE86-001445] N86-21700

AMPLIFIER DESIGN
The RTJ1200 video amplifier. Investigation of low noise, low distortion amplifiers for low source impedance [REPT-52/83/54] N86-21753

AMPLIFIERS
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261

AMPLITUDES
Effect of flow oscillations on cavity drag and a technique for their control [NASA-CR-176652] N86-21519
Electrodermal changes corresponding to the degree of discomfort induced by motion sickness [NAL-TR-880] N86-22096
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles [AD-A161333] N86-22310

ANALOG DATA
Optical acquisition, image and data compression [AD-A161650] N86-22393

ANALOG TO DIGITAL CONVERTERS
A new implementation of the pipeline analog-to-digital conversion technique N86-21745
Advanced mail systems technology. Executive summary and appendices A-G [AD-A161003] N86-22131
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide [AD-A161324] N86-22158
Bimodal optical computer [AD-A161399] N86-22187

ANALYSIS (MATHEMATICS)
Geometrically nonlinear analysis of shell structures using flat DKT shell elements [AD-A162729] N86-21964
Set theory and topology N86-22123
Investigation of perturbation techniques for nonlinear difference equations and other related problems [DE86-001162] N86-22224
Existence of random variables with values in the dual of a nuclear space [AD-A161343] N86-22233

ANALYTICAL CHEMISTRY
Extended abstracts, 36th International Society of Electrochemistry held at Salamanca, Spain on 23-28 September 1985 [AD-A162434] N86-21644

ANGLE OF ATTACK
Computation of three dimensional potential flow around a finite wing with a leading-edge discontinuity at high angle of attack N86-21504
Measurements of the symmetric aerodynamic coefficients for flat faced cylinders with strakes in the angle of attack regime 70 to 90 deg for transonic speed [FFA-TN-1985-39] N86-21523
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft [DFVLR-FB-85-50] N86-21541
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation [NASA-TM-86410] N86-21549
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack [AD-A162407] N86-21801

ANGULAR DISTRIBUTION
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios [DE86-000789] N86-21834
Flow of nuclear matter [DE86-001484] N86-22384

ANGULAR RESOLUTION
Surface states on simple metal surfaces N86-22328
Angle resolved photoemission studies of electronic structure N86-22329
Angle resolved photoemission and band structure of Cu3Au N86-22335

ANIONS
Improved amphoteric ion exchanger and its manufacturing method [DE86-001608] N86-21836

ANISOTROPY
Study of transport properties and structure of extended-chain polymers [AD-A162765] N86-21694
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases [AD-A162766] N86-21695
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation [NASA-CR-175015] N86-21952
U9B: Ultraviolet biophysics N86-22357
Alpha-particle-driven instability of alfven waves in a tandem mirror [DE86-000741] N86-22382

ANNEALING
Markov chains with rare transitions and simulated annealing [AD-A161598] N86-22237

ANNIHILATION REACTIONS
Measurements of proton-proton and proton-antiproton elastic scattering at the European Center for Nuclear Research Intersecting Storage Rings N86-22324
Concepts, problems and opportunities for use of annihilation energy: An annotated briefing on near-term RDT/E to assess feasibility [AD-A161719] N86-22434

ANNUAL VARIATIONS
Large scale precipitation variations over South America during the 1982-83 ENSO EVENT [INPE-3676-PRE/827] N86-22059
Monthly and Seasonal Weather Outlook for Mid-September to Mid-October 1985, Volume 39, Number 18: September 14, 1985 [PB86-104684] N86-22071

Monthly and Seasonal Weather Outlook for September 1985, Volume 39, Number 17: August 30, 1985
[PB86-101672] N86-22072

ANTARCTIC REGIONS
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109

ANTENNA ARRAYS
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Optically controlled phased array antenna concepts using GaAs monolithic microwave integrated circuits
[NASA-TM-87229] N86-21757

ANTENNAS
An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728
Adaptive antenna nulling performance in a dispersive propagation medium
[AD-A162708] N86-21739
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Plasma production with rotating ion cyclotron wave excited by Nagoya Type-3 antennas in RFC-XX
[IPPJ-752] N86-22403

ANTIBIOTICS
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099

ANTIBODIES
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

ANTIGENS
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants
[AD-A162444] N86-22085

ANTIMATTER
Concepts, problems and opportunities for use of annihilation energy: An annotated briefing on near-term RDT/E to assess feasibility
[AD-A161719] N86-22434

ANTIMISTING FUELS
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933

ANTIMONY
Modulation of IR lasers by semiconducting plasma
N86-22256

APERTURES
Laser propagation code study
[AD-A161370] N86-21842

APOLLO 15 FLIGHT
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Regolith erosion and regolith mixing at the Apollo 15 site on the moon N86-22511
Apollo 15 mare units and their petrogenesis
N86-22512
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513
Apollo 15 mare volcanism: Constraints and problems
N86-22515
Hadley Rille, lava tubes and mare volcanism at the Apollo 15 site N86-22516
The geologic history of quartz-normative and olivine-normative basalts in the vicinity of Hadley Rille (Apollo 15) N86-22517
Chemical components of the Apollo 15 regolith
N86-22518
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519
Ultramafic parent magmas for mare basalts?
N86-22520
Spectral reflectance study of the Hadley-Appenine (Apollo 15) region N86-22521
Samples at the Apollo 15 landing site: Types and distribution N86-22522
Apollo 15 mare basalts: A diverse suite or two distinct groups? N86-22523
Apollo 15 regolith breccias and soils: Comparative petrology and chemistry N86-22524
The materials and formation of the imbrium basin
N86-22525
The Apennine Bench Formation revisited N86-22526
Some observations on the geology of the Apollo 15 landing site N86-22527
The origin of pristine KREEP: Effects of mixing between ur KREEP and the magmas parental to the MG-rich cumulates N86-22528
Geologic setting of the Apollo 15 landing site
N86-22529
Selection of the Apollo 15 landing site N86-22530

APPLICATIONS PROGRAMS (COMPUTERS)
Ada reusability guidelines
[AD-A161259] N86-22157

APPROXIMATION
Comparative accuracy of the Albedo, transmission and absorption for selected radiative transfer approximations
[NASA-RP-1160] N86-22022
CWI Newsletter, no. 2, March 1984
[CWI-NEWSLETTER-2] N86-22117
Recent progress on the numerical verification of the Riemann hypothesis N86-22120
CWI Newsletter, no. 7, June 1985
[CWI-NEWSLETTER-7] N86-22121
Second order approximations N86-22122
Implicit B-differentiability in generalized equations
[AD-A160980] N86-22205
The reduction of perturbed markov generators: An algorithm exposing the role of transient states
[AD-A162773] N86-22219
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236
Analytic theory of the nonlinear M = 1 tearing mode
[DE86-001783] N86-22412

ARC LAMPS
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844

ARCHITECTURE
Passive and hybrid solar systems N86-21986

ARCHITECTURE (COMPUTERS)
Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765
Automated generation of microcontrollers
[AD-A162668] N86-21775
Parallel architectures for computer graphics displays
N86-22126
Architectural elements for bitmap graphics
N86-22127
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
A parallel stack processor to reduce procedure-call overhead
[AD-A162494] N86-22140
ANIMAC: A multiprocessor architecture for real time computer animation N86-22149
Parallel implementation of preconditioned conjugate gradient methods
[AD-A161988] N86-22186
A hierarchical approach to reliability modeling of fault-tolerant systems
[NASA-CR-176654] N86-22251

ARCTIC REGIONS
Spectroscopic observations of the aurora and nightglow at Svalbard N86-22028

ARGON
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
Observations of airglow O2 (1 sigma) atmospheric band at 8645A and the rotational temperature at 23 S
N86-22030

ARGON LASERS
Hysteresis effects in Ar+ laser with nonlinear absorber in the cavity N86-22268

ARMED FORCES (UNITED STATES)
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
The Army Research Institute Unit Performance Research and Development Center
[NASA-CR-176618] N86-21706
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
A guide to promote the use of electronic spreadsheets among Air Force personnel
[AD-A161682] N86-22164
Specification technology guidelines
[AD-A162655] N86-22178
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
Applications of computers as an aid to decision-making in Air Force System Program Offices
[AD-A161784] N86-22442

ARRAYS
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor
[DE86-001461] N86-22143
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406

ARTIFICIAL INTELLIGENCE
Installing a copy of the ARPA/DMA image understanding testbed at the US Army Engineer Topographic Laboratories
[AD-A158394] N86-21818
Artificial intelligence and its use in cost type analyses with and example in cost performance measurement
[AD-A161817] N86-22168
Methods of conceptual clustering and their relation to numerical taxonomy
[AD-A160221] N86-22191

ARTIFICIAL SATELLITES
Japan report: Science and technology
[JPRS-JST-86-001] N86-21723
Earth sensor for artificial satellite control discussed
N86-21724
Fabricate, calibrate and test a dosimeter for integration into the CRRES (Combined Release and Radiation Effects Satellite)
[AD-A161695] N86-21825
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023

ASCENT PROPULSION SYSTEMS
Analysis of Jimsphere pairs for use in assessing Space Vehicle ascent capability
[NASA-TP-2573] N86-21506

ASSEMBLIES
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500

ASSUMPTIONS
Invariance principles under a two-part mixing assumption
[AD-A162800] N86-22223

ASSURANCE
Handbook for SRM (Standard Reference Materials) users
[PB86-110897] N86-21649
Quality assurance for the acid precipitation measurement program in the US
[PB86-107034] N86-22011

ASTEROIDS
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208

ASTRONOMICAL MAPS
Soft X-ray maps of the Large Magellanic Cloud (LMC)
N86-22480

ASTRONOMICAL MODELS
A relativistic rotating massive object with saturation of magnetic monopoles — galactic nuclei, quasars
N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object — galactic nuclei, quasars N86-22479

ASTRONOMICAL OBSERVATORIES
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461

ASTRONOMICAL PHOTOGRAPHY
Spectral imaging with a CID camera
[AD-A161608] N86-21824

ASTRONOMICAL PHOTOMETRY
Archive of observations of periodic comet Crommelin made during its 1983-84 apparition
[NASA-CR-176650] N86-22508

ASTRONOMICAL TELESCOPES
Method of determining the thermal deformations of astronomical mirrors
[NASA-TM-77941] N86-22457
ASYMPTOTIC METHODS
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
The asymptotic behavior of an exponential-type series
[AD-A162574] N86-22394
ASYMPTOTIC SERIES
Asymptotic analysis of a mode 1 crack propagating steadily in a deformation theory material
[AD-A161770] N86-21689
The reduction of perturbed markov generators: An algorithm exposing the role of transient states
[AD-A162773] N86-22219
M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
ATMOSPHERIC BOUNDARY LAYER
Soliton turbulence
[NASA-CR-3969] N86-22056
Air mass modification in the marginal ice zone
[AD-A161745] N86-22062
ATMOSPHERIC CHEMISTRY
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
Spectroscopic, kinetic, and dynamic experiments on atmospheric species
[AD-A162691] N86-22050
ATMOSPHERIC CIRCULATION
A meridional circulation model to study upper atmosphere seasonal phenomena
[INPE-2716-PRE/852] N86-22058
Wind driven ocean modeling and ocean model development
[AD-A161742] N86-22074
ATMOSPHERIC COMPOSITION
Characterization of reactants, reaction mechanisms and reaction products in atmospheric water droplets: Fog, cloud, dew and rain water chemistry
[PB86-107976] N86-22017
Vertical distribution of acetonitrile in the atmosphere
[AERONOMICA-ACTA-A-300-1985] N86-22021
Spectroscopic, kinetic, and dynamic experiments on atmospheric species
[AD-A162691] N86-22050
ATMOSPHERIC DENSITY
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048
ATMOSPHERIC ELECTRICITY
Atmospheric electric fields: A numerical approach
[INPE-3704-PRE/844] N86-22025
Earthquake light
[AD-A161385] N86-22042
ATMOSPHERIC MODELS
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023
The nightglow hydroxl (8-3) band emission: A comparison of experiment and theory N86-22031
Initial simulations of the high latitude thermosphere and ionosphere with a coupled three dimensional model
N86-22039
Interactions between unstable baroclinic and resonant, topographic waves in a two-layer model of the atmosphere N86-22055
ATMOSPHERIC PHYSICS
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048
Measurement of atmospheric transmission over long paths in the infrared spectral region
[AD-A161258] N86-22392
ATMOSPHERIC PRESSURE
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
ATMOSPHERIC SCATTERING
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015
Multiple scattering and radiative transfer in planetary atmospheres N86-22035
ATMOSPHERIC SOUNDING
Proceedings of the 12th Annual Meeting on Atmospheric Studies by Optical Methods
[AP-23] N86-22027
Kinetics and spectroscopy of high altitude infrared emissions
[PSI-G050-SR-207] N86-22032
Middle infrared emission studies in the upper atmosphere by rocket techniques N86-22033
Scintillation Detecting and Ranging (scidar/lidar) description of a gravity wave and associated turbulence
N86-22034
ATMOSPHERIC TEMPERATURE
Monthly and Seasonal Weather Outlook for Mid-September to Mid-October 1985, Volume 39, Number 18: September 14, 1985
[PB86-104684] N86-22071
Monthly and Seasonal Weather Outlook for September 1985, Volume 39, Number 17: August 30, 1985
[PB86-101672] N86-22072
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
ATMOSPHERIC TURBULENCE
Scintillation Detecting and Ranging (scidar/lidar) description of a gravity wave and associated turbulence
N86-22034
ATOMIC BEAMS
Intense beams of cold atoms for laser spectroscopy
N86-22282
ATOMIC COLLISIONS
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/)
[DE86-001480] N86-22322
ATOMIC ENERGY LEVELS
Some aspects of the phenomenological and microscopic theory of nuclear collective motion N86-22374
ATOMIC RECOMBINATION
Atom recombination as a source of airglow
N86-22036
ATOMIC SPECTRA
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406
ATOMIC STRUCTURE
Angle resolved photoemission studies of electronic structure N86-22329
Core level shifts and electronic structure of Cu3Au
N86-22334
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl
N86-22366
ATOMS
A tunneling microscope for operation in air or fluids
[AD-A161325] N86-21819
Intense beams of cold atoms for laser spectroscopy
N86-22282
Enhancing efficiency of atom ionization by pulsed periodic lasers N86-22285
Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297
Extreme ultraviolet emission spectroscopy of atoms and laser applications N86-22313
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/)
[DE86-001480] N86-22322
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431
ATTITUDE (INCLINATION)
Spectral imaging with a CID camera
[AD-A161608] N86-21824
ATTITUDE CONTROL
Analysis of the capture of the nominal equilibrium position for the first Brazilian satellite
[INPE-3694-PRE/839] N86-21571
ATTITUDE INDICATORS
Earth sensor for artificial satellite control discussed
N86-21724
AUDIO FREQUENCIES
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
AUDITORY PERCEPTION
Attention within auditory word perception
[AD-A162550] N86-22111
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
AURORAL SPECTROSCOPY
Spectroscopic observations of the aurora and nightglow at Svalbard N86-22028
Kinetics and spectroscopy of high altitude infrared emissions
[PSI-G050-SR-207] N86-22032
Experimental and theoretical information on radiative lifetimes and oscillator strengths — aeronomy
N86-22037
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038
An intensified photodiode array applied to one-dimensional auroral imaging N86-22040
Observations of auroral and airglow spectra using a grating spectrometer with an imaging photon detector
N86-22041
AURORAS
Spectroscopic observations of the aurora and nightglow at Svalbard N86-22028
AUTOCORRELATION
Time and frequency dependent behavior of a two dimensional electron gas at long wavelengths
[AD-A162546] N86-21773
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234
AUTOIONIZATION
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358
Photoelectron spectroscopy of autoionizing Rydburg states in small molecules N86-22362
AUTOMATA THEORY
Simulations among multidimensional iterative arrays, iterative tree automata, and alternating turning machines
[AD-A162661] N86-22142
AUTOMATIC CONTROL
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560
Automated instrument for qualitative analysis of photographically recorded spectra
[DE86-001621] N86-21833
Automated weld torch guidance control system
[NASA-CASE-MFS-25807-2] N86-21850
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
Tutorials on self-tuning control. Volume 2: Automatic tuning of PID regulators
[OUEL-1593/85-VOL-2] N86-22197
Contact X-ray microscopy of biological materials
N86-22370
AUTOMATIC LANDING CONTROL
Algorithms for the automatic four-dimensional guidance of aircraft, taking into account the current wind situation
[ESA-TT-908] N86-21531
AUTOROTATION
Helicopter performance computer programs for HP-41 hand-held computer
[AD-A162794] N86-21539
AUXILIARY PROPULSION
A bibliography of electrothermal thruster technology, 1984
[NASA-TM-86998] N86-21578
AVALANCHE DIODES
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21788
AVIONICS
An analysis of foreign source dependence for critical microcircuits of USAF avionics components
[AD-A161311] N86-22436
AXES OF ROTATION
Earth sensor for artificial satellite control discussed
N86-21724
AXIAL LOADS
The dynamic response of composite beams to axial impact N86-21603
AXIAL STRESS
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665

B

B-52 AIRCRAFT
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536

BACKGROUND RADIATION
The X-ray background — galactic radiation
N86-22463

BACKSCATTERING
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310

BACTERIA
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants
[AD-A162444] N86-22085
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

BALL BEARINGS
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether
[NASA-TM-87260] N86-21575
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857

BALLISTICS
Viscous fluid motion in a spinning and nutating cylinder
[AD-A162686] N86-21804
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

BANACH SPACE
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206

BAND STRUCTURE OF SOLIDS
Angle resolved photoemission and band structure of Cu3Au
N86-22335

BANDWIDTH
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731

BARIUM ION CLOUDS
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029

BAROCLINIC INSTABILITY
Interactions between unstable baroclinic and resonant, topographic waves in a two-layer model of the atmosphere
N86-22055

BASALT
Extraction of information from major element chemical analyses of lunar basalts N86-22514
Chemical components of the Apollo 15 regolith
N86-22518
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519
Ultramafic parent magmas for mare basalts?
N86-22520
Samples at the Apollo 15 landing site: Types and distribution N86-22522
Apollo 15 mare basalts: A diverse suite or two distinct groups? N86-22523
Some observations on the geology of the Apollo 15 landing site N86-22527
The origin of pristine KREEP: Effects of mixing between ur KREEP and the magmas parental to the MG-rich cumulates N86-22528

BATCH PROCESSING
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188

BATTERY CHARGERS
Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979

BAYES THEOREM
Recursive estimation for nonlinear Wiener systems by online implementation of Baye's rule
[OUEL-1471/83] N86-22226
The 25th Conference on Statistical Theory and Practice held at the University of Wisconsin, Madison on 29-31 May 1985
[AD-A162645] N86-22244

BEAM INJECTION
Numerical simulation of an accelerator injector
[DE86-001572] N86-22385
Recent progress of the advanced test accelerator
[DE86-001578] N86-22386

BEAM WAVEGUIDES
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380

BEAMS (RADIATION)
Slow combustion of laser plasma and optical charges
N86-22290
Beam line U5: (FEL and diagnostic line) N86-22330
X-ray holography experiments on the U15 beam line
N86-22371
Gas phase spectroscopy in the soft X-ray region of the U15 beamline N86-22373
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381

BEAMS (SUPPORTS)
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
The dynamic response of composite beams to axial impact N86-21603
Beam dampers for skin vibration and noise reduction in the 747 N86-21917

BEARINGS
Quasi-modal vibration control by means of active control bearings
[NASA-TM-87232] N86-21856

BENDING
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
Contribution of bending energy losses to the apparent tear energy
[AD-A162775] N86-21696
Modified finite strip method with spline functions
N86-21878
Controlled impact demonstration airframe bending bridges N86-21943
Impact dynamics instrumentation N86-21948

BENDING MOMENTS
Controlled impact demonstration airframe bending bridges N86-21943

BENZENE
Studies on the oxidation of hexamethylbenzene 1: Oxidation of hexamethylbenzene with nitric acid
[NASA-TM-77945] N86-21628
Studies on the oxidation of hexamethylbenzene 2: Preparation of dimethylpyromellitic acid
[NASA-TM-77946] N86-21629
Microvoltammetric electrodes
[AD-A161653] N86-21642
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695

BERYLLIUM
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410

BETA FACTOR
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas
[IPPJ-751] N86-22402

BIBLIOGRAPHIES
Contemporary achievements in astronautics: Salyut-7, the Vega Project and Spacelab
[NASA-TM-77712] N86-21563
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 282)
[NASA-SP-7011(282)] N86-22093
NASA patent abstracts bibliography: A continuing bibliography. Section 2: Indexes (supplement 28)
[NASA-SP-7039(28)] N86-22444
Scientific and technical information output of the Langley Research Center for Calendar Year 1985
[NASA-TM-87655] N86-22445

BINARY ALLOYS
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21663

BINARY STARS
On the variability of Sigma Geminorum: An interesting candidate for X-ray studies — binary star N86-22476
The X-ray spectra and the rotation-activity connection of RS CVN binaries N86-22482

BINDERS (MATERIALS)
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046

BIOASSAY
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089
Biomedical and environmental sciences at Oak Ridge National Laboratory
[DE86-001639] N86-22091
Contact X-ray microscopy of biological materials
N86-22370
Scanning soft X-ray microscopy on the U15 beam line
N86-22372

BIOLOGICAL EFFECTS
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 282)
[NASA-SP-7011(282)] N86-22093

BIOMAGNETISM
European Science Notes. Volume 39, number 12
[AD-A161069] N86-21721

BIOMEDICAL DATA
Biomedical and environmental sciences at Oak Ridge National Laboratory
[DE86-001639] N86-22091
The Statistical Analysis Program Package (SAPP): A special data analysis program
[OEFZS-4326] N86-22248

BIOPHYSICS
U9B: Ultraviolet biophysics N86-22357

BIOSYNTHESIS
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content
[AD-A161811] N86-22063
Lymphocyte activation - regulatory substances
[AD-A162683] N86-22087

BIOTECHNOLOGY
Biomedical and environmental sciences at Oak Ridge National Laboratory
[DE86-001639] N86-22091
Japanese Technology Evaluation Program (JTECH): Biotechnology Panel
[PB86-109386] N86-22092
Exploring the utility of a staged technology assessment process, volume 2
[PB86-109410] N86-22454

BIPOLAR TRANSISTORS
Numerical model and analysis of transistors with polysilicon emitters N86-21750
Programmable, automated transistor test system
[NASA-TP-2554] N86-21755

BIREFRINGENCE
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624

BIREFRINGENT FILTERS
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Wavelength switching in copper-vapor lasers
N86-22275

BITS
Architectural elements for bitmap graphics
N86-22127

BLACK BODY RADIATION
Measurement of atmospheric transmission over long paths in the infrared spectral region
[AD-A161258] N86-22392
Infrared sensor target
[AD-D011996] N86-22398

BLANKS
Method of chemically polishing quartz crystal blanks
[AD-D011975] N86-21722

BLAST LOADS
Airblast loading of wall panels
[FOA-C-20586-D6] N86-21966

BLOCKING
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188

BLUNT BODIES
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air
N86-21632

BODY TEMPERATURE
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102

BODY-WING CONFIGURATIONS
Comparison of computational results of a few representative three-dimensional transonic potential flow analysis programs
[NASA-TM-77963] N86-21509
BOLOMETERS
Bolometers as spectrometers for X-ray astronomy N86-22496
BOLTS
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950
BOLTZMANN TRANSPORT EQUATION
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
BOMBS (ORDNANCE)
An eight-inch diameter, heavily confined card gap test
[AD-A161557] N86-21705
BOOMS (EQUIPMENT)
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540
BOOSTGLIDE VEHICLES
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
BOREHOLES
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077
BORON
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Rapidly solidified alloys of iron-rare earth boron for permanent magnets N86-21652
Effect of boron on tensile properties of B2 BeAl
[NASA-CR-175074] N86-21656
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344
BORON CARBIDES
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
BORON NITRIDES
Boronnitride and siliconnitride systems
[AD-A161563] N86-21640
BORON OXIDES
Contribution to the photometric determination of small amounts of boron trioxide in glasses
[NASA-TM-77955] N86-21677
BOSONS
Some aspects of the phenomenological and microscopic theory of nuclear collective motion N86-22374
BOUNDARIES
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
A study of singularities in boundary-fitted coordinate systems
[AD-A161756] N86-22214
BOUNDARY LAYER COMBUSTION
The influence of initial and boundary conditions on gaseous detonation waves
[AD-A162631] N86-21803
BOUNDARY LAYER FLOW
Comparison of computational results of a few representative three-dimensional transonic potential flow analysis programs
[NASA-TM-77963] N86-21509
Studies of acoustic effects on a flow boundary layer in air
[NASA-TM-77981] N86-21792
The evolution of a wave train in a three-dimensional boundary layer
[FFA-TN-1985-54] N86-21809
BOUNDARY LAYER SEPARATION
Bifurcation and stability of complex flows
[AD-A161405] N86-21799
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack
[AD-A162407] N86-21801
BOUNDARY LAYER TRANSITION
A new method for laminar boundary layer transition visualization in flight: Color changes in liquid crystal coatings
[NASA-TM-87666] N86-21518
Development of perturbations in the boundary layer
[NASA-TM-77986] N86-21793
Laminar boundary layer in conditions of natural transition to turbulent flow
[NASA-TM-77985] N86-21796
Interactions between unstable baroclinic and resonant, topographic waves in a two-layer model of the atmosphere N86-22055
BOUNDARY LAYERS
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519
Boundary layer effects in nearly incompressible cracked bodies N86-21605
BOUNDARY VALUE PROBLEMS
Three-dimensional boundary layer analysis program Blay and its application
[NASA-TM-77962] N86-21516
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack
[AD-A162407] N86-21801
The influence of initial and boundary conditions on gaseous detonation waves
[AD-A162631] N86-21803
On the boundary treatment in spectral methods for hyperbolic systems
[NASA-CR-178055] N86-22204
Nonlinear acoustic wave propagation in atmosphere
[NASA-CR-176642] N86-22309
BOUSSINESQ APPROXIMATION
Systematics of strongly self-dominant higher order differential equations based on the painleve analysis of their singularities
[AD-A162545] N86-22216
BOX BEAMS
Equivalent plate analysis of aircraft wing box structures with general planform geometry
[NASA-TM-87697] N86-21954
BRAGG ANGLE
The XMM imaging Bragg spectrometer with a doubly curved crystal N86-22493
BRAKING
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
BRANCHING (PHYSICS)
Photon energy dependent branching ratios of the inner valence satellites in the photoemission of solid ethylene N86-22336
BRAYTON CYCLE
Technology for Bayton-cycle powerplants using solar and nuclear energy
[NASA-TP-2558] N86-21577
BREADBOARD MODELS
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
BREATHING APPARATUS
Evaluation of a passenger mask modified with a rebreather bag for protection from smoke and fumes
[AD-A162473] N86-22116
BRECCIA
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513
Chemical components of the Apollo 15 regolith N86-22518
BRIGHTNESS
Recent progress of the advanced test accelerator
[DE86-001578] N86-22386
BRITTLENESS
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
BROADBAND
Development of improved broadband cable system communications
[AD-A161559] N86-21766
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406
BROMINE
A comparison of the bromination dynamics of pitch-based and vapor-grown graphite fibers
[NASA-TM-87275] N86-21683
BROMINE COMPOUNDS
Bimane derivatives as fluorescent probes for biological macromolecules
[AD-A162725] N86-22088
BRONZES
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
BROWNIAN MOVEMENTS
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
BUBBLE CHAMBERS
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381
BUCKLING
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
Effects of thickness and ply orientation on buckling of laminated plates
[NASA-TM-87691] N86-21617
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
BUFFER STORAGE
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
BUILDINGS
Airblast loading of wall panels
[FOA-C-20586-D6] N86-21966
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015
BURNERS
High-temperature ceramic recuperator and combustion air burner programs: Seal development
[PB86-105079] N86-21870
Burner technology bulletin: Control of NOx emissions from residential gas appliances
[PB86-103892] N86-21873
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932

C

C BAND
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
CADMIUM
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358
CADMIUM COMPOUNDS
VUV optical properties of cadmium dimethyl N86-22354
CADMIUM SELENIDES
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
CADMIUM SULFIDES
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
CADMIUM TELLURIDES
The effect of contacts on the counting characteristics of heavily doped n-type cadmium telluride N86-21746
CALCULATORS
Helicopter performance computer programs for HP-41 hand-held computer
[AD-A162794] N86-21539
CALCULUS OF VARIATIONS
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
CALIBRATING
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[DFVLR-FB-85-50] N86-21541
Relative intensity-energy calibration of X-ray photoelectron spectrometers: Instructions for the use of reference materials SCAA83
[NPL-DMA(A)-97] N86-21813
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios
[DE86-000789] N86-21834
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
Controlled impact demonstration airframe bending bridges N86-21943
CALIFORNIA
Characterization of reactants, reaction mechanisms and reaction products in atmospheric water droplets: Fog, cloud, dew and rain water chemistry
[PB86-107976] N86-22017
CALIFORNIUM ISOTOPES
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378
CALORIMETERS
The measuring assembly for a primary standard absorbed dose calorimeter --- high energy particle beams
[NPL-RS(EXT)-74] N86-21814

Studies of e(+)e(-) interactions
[DE86-001656] N86-22388
CAMERAS
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
High sensitivity, one-sided X-ray inspection system
[AD-A162567] N86-21875
CANADA
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
CANOPIES
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
CANS
Finite element analysis of the Roquefort diagnostic canister
[DE86-000837] N86-22184
CANTILEVER BEAMS
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
CARBIDES
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
CARBON
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Microvoltammetric electrodes
[AD-A161653] N86-21642
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
Fragmentation of small molecules following soft X-ray absorption near the carbon K-edge N86-22333
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
Photon stimulted desoprtion of ions from polymer surfaces N86-22367
CARBON DIOXIDE
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide
[AD-A162694] N86-21645
CARBON DIOXIDE LASERS
Infrared diagnosis using liquid crystal detectors
[NASA-TM-77999] N86-21815
Effect of pulse dependent discharge on relaxing gas flow N86-22265
IGLAN-3 multibeam CW gas-discharge CO2 laser N86-22266
Investigation of electroionization pulsed carbon dioxide isotope output characteristics N86-22267
High-power CO2 electric discharge laser with easily ionized substances added N86-22270
CARBON DISULFIDE
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
CARBON FIBER REINFORCED PLASTICS
Carbon-fiber reinforced epoxy techniques for the X-ray Multimirror Mission (XMM) Low-Energy (LE) telescopes N86-22490
CARBON FIBERS
Characterization of carbon fibers and fiber-matrix adhesion in composites N86-21612
CARBON MONOXIDE
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
The adsorption of carbon monoxide on palladium films N86-22340
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Deexcitation electron spectroscopy of free and coordinated CO N86-22363
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428
CARBON 13
Development of LC-13C NMR
[NASA-CR-176656] N86-21704
CARBON-CARBON COMPOSITES
Dual material exhaust nozzle flap
[AD-D011998] N86-21548
Fracture morphology of 2-D carbon-carbon composition N86-21599
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
A new NDE method for coated carbon-carbon composites
[AD-D011978] N86-21625
CARBONACEOUS MATERIALS
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
CARBOXYLIC ACIDS
Synthesis of pyromellitic acid esters
[NASA-TM-77977] N86-21583
Studies on the oxidation of hexamethylbenzene 1: Oxidation of hexamethylbenzene with nitric acid
[NASA-TM-77945] N86-21628
Studies on the oxidation of hexamethylbenzene 2: Preparation of dimethylpyromellitic acid
[NASA-TM-77946] N86-21629
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425
CARDIOVASCULAR SYSTEM
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100
CARTESIAN COORDINATES
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
CASCADE FLOW
Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
CASTINGS
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
CATALOGS (PUBLICATIONS)
Safeguards instrumentation: A computer-based catalog, second edition
[DE86-000840] N86-21835
CATALYSTS
Burner technology bulletin: Control of NOx emissions from residential gas appliances
[PB86-103892] N86-21873
CATALYTIC ACTIVITY
Re-evaluation of surface properties of oxide-cathode materials
[AD-A161131] N86-21687
CATECHOLAMINE
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100
CATHODES
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Recent progress of the advanced test accelerator
[DE86-001578] N86-22386
CATIONS
Improved amphoteric ion exchanger and its manufacturing method
[DE86-001608] N86-21836
CAVITATION FLOW
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519
F100 fuel sampling analysis
[AD-A161667] N86-21707
Experimental studies on cavitation inception in a submerged jet
[OUEL-1586/85] N86-21811
CAVITIES
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
CAVITY RESONATORS
Repetitively pulsed Q-switched chemical oxygen-iodine laser
[AD-D011989] N86-21848
CELLS (BIOLOGY)
Proceedings: Protons and Membrane Reactions held at Santa Barbara, California on 28 January - 1 February 1985
[AD-A161331] N86-22082
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089
CELLULOSE NITRATE
Complexes of nitrocellulose with cupric chloride
[AD-A162519] N86-21589
CENSORED DATA (MATHEMATICS)
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232
CERAMICS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Manufacture of high-density ceramic sinters
[NASA-TM-77925] N86-21678
Capsulation of moldings made from silicon ceramic material
[NASA-TM-77933] N86-21680
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
Shock-compression processes in inorganic powders
[DE86-002920] N86-21698
Amphibole ceramics: Conceptual development and preliminary experiments
[DE86-001445] N86-21700
Removal of glass adhered to sintered ceramics in hot isostatic pressing
[NASA-TM-77930] N86-21719
High-temperature ceramic recuperator and combustion air burner programs: Seal development
[PB86-105079] N86-21870
Shock fracture and recompaction of ceramics N86-21879
CERENKOV COUNTERS
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536
CERENKOV RADIATION
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380
CERTIFICATION
General aviation pilot and aircraft activity survey
[AD-A161665] N86-21530
An experimental appraisal of the use of ground-plane microphones for aircraft noise measurement — certification tests
[NPL-AC-104] N86-22302
CHANNEL FLOW
Losses in channels with increased internal turbulence
[NASA-TM-77995] N86-21515
CHANNELS (DATA TRANSMISSION)
Sequential decoding for multiple access channels
[AD-A162630] N86-21738
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
CHAOS
Chaos and nonlinear dynamics of single-particle orbits in a magnetotail-like magnetic field
[AD-A161750] N86-22045
CHARGE COUPLED DEVICES
X-ray applications of deep-depletion CCDs — astronomy N86-22504
X-ray imaging spectroscopy with CCDs — X ray astronomy N86-22505
CHARGE INJECTION DEVICES
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
CHARGE TRANSFER
Charge transfer complexes of certain aromatic polyimides
[NASA-TM-77974] N86-21631
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Correlations between electrochemical potentials and optical charge transfer energies in ruthenium bipyridine derivatives
[AD-A161668] N86-22317
Core level shifts and electronic structure of Cu3Au N86-22334
CHARGED PARTICLES
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
CHARM (PARTICLE PHYSICS)
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381
CHECKOUT
A graphical debugger for concurrent Ada programs N86-22147

CHEMICAL ANALYSIS
The 12th International Conference on Organometallic Chemistry held at Congress center Hofburg, Vienna on 8-13 September 1985. Abstracts
[AD-A161039] N86-21585
Coincidental chemical signature identifier
[AD-A161269] N86-21637
Handbook for SRM (Standard Reference Materials) users
[PB86-110897] N86-21649
Quantitative methods for the chemical analysis of sealing glasses
[DE86-001662] N86-21702
Development of LC-13C NMR
[NASA-CR-176656] N86-21704
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
Extraction of information from major element chemical analyses of lunar basalts N86-22514

CHEMICAL ATTACK
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711

CHEMICAL BONDS
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584
Metal-insulator transition on the Ge(001) surface N86-22327

CHEMICAL CLEANING
Method of chemically polishing quartz crystal blanks
[AD-D011975] N86-21722

CHEMICAL COMPOSITION
Coincidental chemical signature identifier
[AD-A161269] N86-21637
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N86-21685

CHEMICAL COMPOUNDS
Coincidental chemical signature identifier
[AD-A161269] N86-21637

CHEMICAL ENGINEERING
Japan report: Science and technology
[JPRS-JST-86-001] N86-21723
Opportunities in pulse combustion
[DE86-001436] N86-22003

CHEMICAL EQUILIBRIUM
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711

CHEMICAL EXPLOSIONS
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712

CHEMICAL LASERS
Behavior of singlet oxygen in the oxygen-iodine transfer laser
[AD-A161390] N86-21843
Repetitively pulsed Q-switched chemical oxygen-iodine laser
[AD-D011989] N86-21848
H2/F2 chemical laser initiated by excimer flashlamp N86-22276

CHEMICAL PROPERTIES
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
Ni, Pd and Pt overlayers on Ta(110) N86-22341

CHEMICAL REACTIONS
Experiments on entrainment, mixing and chemical reactions in turbulent jets at large Schmidt number N86-21503
The 12th International Conference on Organometallic Chemistry held at Congress center Hofburg, Vienna on 8-13 September 1985. Abstracts
[AD-A161039] N86-21585
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane
[AD-A162548] N86-22426

CHEMICAL TESTS
Thin-film chemical sensors based on electron tunneling
[NASA-CR-176662] N86-22418

CHEMISTRY
The role of the topological distance matrix in chemistry
[AD-A162523] N86-22252

CHIPS (MEMORY DEVICES)
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
Reducing memory references via effective register usage
[AD-A161352] N86-21760

CHLOROETHYLENE
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162528] N86-22006

CHLOROPHYLLS
Particulate models of photosynthesis
[DE86-001625] N86-22090

CHOLINE
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356

CHROMATOGRAPHY
Microvoltammetric electrodes
[AD-A161653] N86-21642

CHROMIUM
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
The electroplating of laminated chromium
[AD-A162751] N86-21671

CHROMIUM ALLOYS
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952

CHROMIUM CARBIDES
A new chromium carbide-based tribological coating for use to 900 deg C with particular reference to the Stirling engine
[NASA-TM-87274] N86-21682

CHROMIUM COMPOUNDS
Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851

CIRCUIT BOARDS
Computer controlled lead forming
[AD-D011984] N86-22183

CIRCUIT DIAGRAMS
DP format of the drawing files
[AD-A162440] N86-22139

CIRCUITS
Claw grip contact probe for flat packs
[AD-D011997] N86-21782
Low-noise phase/frequency detector
[AD-A161394] N86-21821

CIRCULAR CYLINDERS
Measurements of the symmetric aerodynamic coefficients for flat faced cylinders with strakes in the angle of attack regime 70 to 90 deg for transonic speed
[FFA-TN-1985-39] N86-21523
Effect of a rotor wake on the local heat transfer on the forward half of a circular cylinder
[NASA-TM-87234] N86-21794

CITIES
Spatial classification of urban landscapes from landcovcer probaabilities derived through remote sensing N86-21967
Colorado Water Resources Research Institute activities report, FY 1981-1984
[PB86-101367] N86-21974

CIVIL AVIATION
State-of-the-art review on composite material fatigue/damage tolerance
[FAA/CT-85/7] N86-21615
The history of aeronautical medicine in Venezuela
[NASA-TM-77709] N86-22094
Activities report of the aerospace industry in West Germany
[ISSN-0176-5086] N86-22450

CLADDING
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379

CLASSIFICATIONS
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
The area-time complexity of sorting
[AD-A161562] N86-21767

CLASSIFIERS
The area-time complexity of sorting
[AD-A161562] N86-21767

CLEAVAGE
Oxidation of GaSs(110) cleaved surface N86-22345

CLIMATE
Pacific Marine Environmental Laboratory
[PB86-105525] N86-22078
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22081

CLIMATOLOGY
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024
Current celocity and hydrographic observations of the Straits of Florida: Subtropical Atlantic climate study (STACS) 1983 and 1984
[PB86-108602] N86-22079

CLINICAL MEDICINE
Advanced clinical research in shock and trauma
[AD-A162730] N86-22103

CLOSURES
The synthesis of force closure grasps in the plane
[AD-A162635] N86-21866

CLOUDS
Comparative accuracy of the Albedo, transmission and absorption for selected radiative transfer approximations
[NASA-RP-1160] N86-22022

CLUMPS
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431

CLUSTER ANALYSIS
Methods of conceptual clustering and their relation to numerical taxonomy
[AD-A160221] N86-22191

CLUTTER
Radar-clutter simulator
[AD-D011992] N86-21741
Weather radar studies
[AD-A161622] N86-22061

CMOS
Performance limits of scaled CMOS analog ICs N86-21748
A coherent VLSI design environment
[AD-A161743] N86-21771
Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979

COAGULATION
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099

COAL GASIFICATION
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674

COAL LIQUEFACTION
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674

COASTAL ZONE COLOR SCANNER
CZCS (Coastal Zone Color Scanner) atlas of water optical properties in the alboran sea
[AD-A162503] N86-22075

COATINGS
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
Characterization of plasma-sprayed ferrite coatings N86-21854
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956

COAXIAL CABLES
Monte Carlo calculations on the direct cable drive due to gamma radiation
[AD-A161734] N86-22375

COBALT
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643

COBALT COMPOUNDS
Crack initiation and microstructure in tungsten carbide-cobalt composites N86-21651

Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851

COCKPITS
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

CODING
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
A methodology for applying bar code technology to Aircraft Maintenance Unit support sections
[AD-A161783] N86-22441

COEFFICIENT OF FRICTION
Losses in channels with increased internal turbulence
[NASA-TM-77995] N86-21515

COEFFICIENTS
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234

COGNITION
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437

COHERENT LIGHT
Novel methods for tuning free electron lasers to multiple wavelengths
[AD-D011986] N86-21847

COHERENT RADAR
Solar flare ionization in the mesosphere observed by coherent-scatter radar
[NASA-CR-176649] N86-22534

COHERENT RADIATION
Radiation focusing by prism raster N86-22288

COHERENT SCATTERING
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051

COLD FRONTS
Weather radar studies
[AD-A161622] N86-22061

COLD PLASMAS
Shockwave propagation in low-temperature carbon plasma N86-22260
Relativistic effects during Compton interaction of strong electromagnetic radiation and optically thin layer of cold plasma N86-22295
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297

COLD PRESSING
Silicon carbide sintered products and a method for their manufacturing
[NASA-TM-77932] N86-21679

COLD WEATHER
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109

COLLIMATION
Undulator based beamline studies on U5 N86-22331

COLLISION AVOIDANCE
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
Complexity of the generalized mover's problem
[AD-A161378] N86-22209

COLLISION PARAMETERS
Average collisional vibrational energy transfer quantities. The exponential model
[AD-A161814] N86-22319

COLLISIONAL PLASMAS
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844

COLOR
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
Color image processing with computer-generated spatial filters in a dispersed white-light optical system N86-22125

COLOR CODING
The effects of color-coding in geosit displays. 1: Color as a redundant code
[AD-A161107] N86-22108

COLOR VISION
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104

COLORADO
Colorado Water Resources Research Institute activities report, FY 1981-1984
[PB86-101367] N86-21974
Green River air quality model development. VALMET: A valley air pollution model
[PB86-104106] N86-22013

COMBINATORIAL ANALYSIS
Two applications of topological dynamics in combinatorial number theory N86-22118

COMBUSTION
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528
High-temperature ceramic recuperator and combustion air burner programs: Seal development
[PB86-105079] N86-21870
Characterization of emission rates from indoor combustion sources
[PB86-103900] N86-21874
Opportunities in pulse combustion
[DE86-001436] N86-22003
Slow combustion of laser plasma and optical charges N86-22290

COMBUSTION CHAMBERS
Demonstration test of burner liner strain measuring system
[NASA-CR-174743] N86-21817
Combustion engine for solid and liquid fuels
[NASA-TM-77714] N86-21855
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932

COMBUSTION EFFICIENCY
Combustion engine for solid and liquid fuels
[NASA-TM-77714] N86-21855

COMBUSTION PRODUCTS
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861

COMMAND AND CONTROL
Specification and preliminary validation of IAT (Integrated Analysis Techniques) methods: Executive summary
[AD-A162509] N86-21736
Applications of computers as an aid to decision-making in Air Force System Program Offices
[AD-A161784] N86-22442

COMMAND LANGUAGES
GETWRD package update: New features and modifications to the GETWRD package
[AD-A162698] N86-22179

COMMUNICATION CABLES
Development of improved broadband cable system communications
[AD-A161559] N86-21766

COMMUNICATION NETWORKS
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
A coherent VLSI design environment
[AD-A161743] N86-21771
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Study on routing and flow control in computer networks
[AD-A161768] N86-22189

COMMUNICATION SATELLITES
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731

COMPACTING
Controlled powder morphology experiments in megabar 304 stainless steel compaction
[DE86-002416] N86-21672
Shock-compression processes in inorganic powders
[DE86-002920] N86-21698
Shock fracture and recompaction of ceramics N86-21879

COMPARISON
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories)
[AD-A161664] N86-21537
A comparison of measured spacecraft modal damping values N86-21903
Relative accuracy of ALPEX aircraft data: An evaluation of the ALPEX intercomparison flight with the NCAR (National Center for Atmospheric Research) Electra, the NOAA (National Oceanic and Atmospheric Administration P3 and the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft-und Raumfahrt) Falcon
[PB86-100823] N86-22067

COMPARTMENTS
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213

COMPATIBILITY
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159

COMPENSATORS
A contribution to the digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[DFVLR-FB-85-55] N86-21553

COMPLEX COMPOUNDS
The 12th International Conference on Organometallic Chemistry held at Congress center Hofburg, Vienna on 8-13 September 1985. Abstracts
[AD-A161039] N86-21585

COMPLEX SYSTEMS
Critical damping in complex structures and control systems N86-21927

COMPLEX VARIABLES
Fractional calculus to represent complex modulus N86-21885
Recent progress on the numerical verification of the Riemann hypothesis N86-22120
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188

COMPLEXITY
Complexity results in VLSI and distributed computing N86-21744
Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437

COMPOSITE MATERIALS
Fatigue response of silicon carbide whisker/aluminum matrix composites N86-21591
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Modeling the curing process of thick-section autoclave cured composites N86-21600
The dynamic response of composite beams to axial impact N86-21603
NDE of composite materials using ultrasound: Quantitative optical detection N86-21609
State-of-the-art review on composite material fatigue/damage tolerance
[FAA/CT-85/7] N86-21615
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Aminophenoxycyclotriphosphazene cured epoxy resins and the composites, laminates and structures thereof
[NASA-CASE-ARC-11548-1] N86-21686
NASA experiments on the B-720 structure and seats N86-21936

COMPOSITE STRUCTURES
Design of notched plates under compression N86-21594
Geometric and material nonlinear bending analysis of laminated composite plates and shells N86-21596
Analysis and experiments on interlaminar fracture toughness in resin matrix composites
[AD-A162689] N86-21622
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Aminophenoxycyclotriphosphazene cured epoxy resins and the composites, laminates and structures thereof
[NASA-CASE-ARC-11548-1] N86-21686

COMPOSITE WRAPPING
Development of high order finite elements to model filament wound composites N86-21593

COMPRESSIBILITY
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711

COMPRESSIBLE FLOW
An analysis for the sound field produced by rigid wide cord dual rotation propellers of high solidarity in compressible flow
[NASA-TM-87178] N86-21517

A direct method to calculate disturbance fields of moving bodies at subsonic speeds in compressible media
[DFVLR-FB-85-52] N86-21812
COMPRESSING
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
COMPRESSION LOADS
Response of thick, notched laminates subjected to tension-compression cyclic loads N86-21610
Delamination growth in composite materials
[NASA-CR-178066] N86-21618
COMPRESSOR EFFICIENCY
High frequency-heated air turbojet
[NASA-TM-77710] N86-21543
COMPRESSORS
Volumetric trochoidal gas compressor for use as a heat pump
[PB86-102720] N86-21871
COMPTON EFFECT
Relativistic effects during Compton interaction of strong electromagnetic radiation and optically thin layer of cold plasma N86-22295
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408
The X-ray spectra of bursting neutron stars: Effects of Comptonization and bound-free opacity N86-22475
COMPUTATION
Computation of three dimensional potential flow around a finite wing with a leading-edge discontinuity at high angle of attack N86-21504
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163
Monte Carlo calculations on the direct cable drive due to gamma radiation
[AD-A161734] N86-22375
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408
COMPUTATIONAL FLUID DYNAMICS
Numerical simulation of vortex breakdown
[NASA-TM-77951] N86-21789
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258
COMPUTATIONAL GRIDS
An adaptive mesh algorithm for solving systems of time dependent partial differential equations
[AD-A161822] N86-22215
COMPUTER AIDED DESIGN
Three-dimensional boundary layer analysis program Blay and its application
[NASA-TM-77962] N86-21516
Helicopter performance computer programs for HP-41 hand-held computer
[AD-A162794] N86-21539
Spacecraft propulsion systems mass modelling study: Assumptions and definitions N86-21576
A coherent VLSI design environment
[AD-A161743] N86-21771
Silicon compilation: A solution to the complexity of VLSI (Very Large-Scale Integrated) circuit design
[AD-A162564] N86-21774
Machinability data bases for metal cutting
[AD-A161646] N86-21860
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
Combining computation with geometry N86-22145
The use of quantitative databases in Aladin, an alloy design system
[AD-A162555] N86-22176
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
Robust adaptive control
[AD-A161349] N86-22192
COMPUTER AIDED MANUFACTURING
Machinability data bases for metal cutting
[AD-A161646] N86-21860
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
Computer controlled lead forming
[AD-D011984] N86-22183
COMPUTER AIDED TOMOGRAPHY
Visual perception in correlated noise N86-22106
Optical acquisition, image and data compression
[AD-A161650] N86-22393
COMPUTER ASSISTED INSTRUCTION
Emergency Management Computer-Aided Trainer (EMCAT)
[NASA-CR-178738] N86-21554
Advanced Technology Unit Training and Management System (ATUTMS). User's guide
[NASA-CR-176643] N86-22130
Computer-Based Instruction (CBI): Considerations for a user-oriented technology data base
[AD-A161776] N86-22167
COMPUTER COMPONENTS
Computer controlled lead forming
[AD-D011984] N86-22183
COMPUTER DESIGN
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor
[DE86-001461] N86-22143
COMPUTER GRAPHICS
Graphical techniques to assist in pointing and control studies of orbiting spacecraft
[NASA-TP-2575] N86-21559
Data reduction, management, and analysis software for CID N86-21938
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
Vehicle routing and computer graphics N86-22124
Parallel architectures for computer graphics displays N86-22126
Architectural elements for bitmap graphics N86-22127
DP format of the drawing files
[AD-A162440] N86-22139
The Pythagoras tree as a Julia set N86-22155
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
POLYGON: An interactive program for constructing and editing the geometries of polygons using a color graphics terminal
[DE86-001419] N86-22185
COMPUTER INFORMATION SECURITY
A protection model for distributed data base management systems N86-22128
A decision support system for cost-effectiveness analysis for control and security of computer systems
[AD-A161388] N86-22134
COMPUTER NETWORKS
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
COMPUTER PROGRAM INTEGRITY
Fault diversity in software reliability
[AD-A162757] N86-22182
COMPUTER PROGRAMMING
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport
[AD-A162785] N86-21778
Comparison of manually produced and automated cross country movement maps using digital image processing techniques
[NASA-CR-176653] N86-21969
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
The RANDOM computer program: A linear congruential random number generator
[NASA-CR-176664] N86-22152
The SIMRAND methodology: Theory and application for the simulation of research and development projects
[NASA-CR-176663] N86-22153
An assessment of Ada's suitability in general purpose programming applications
[AD-A161715] N86-22165
Minimization of a six variable boolean function
[AD-A161718] N86-22166
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169
BUILD: A tool for maintaining consistency in modular systems
[AD-A162744] N86-22180
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
Robust adaptive control
[AD-A161349] N86-22192
COMPUTER PROGRAMS
Emergency Management Computer-Aided Trainer (EMCAT)
[NASA-CR-178738] N86-21554
Integrated Composite Analyzer (ICAN): Users and programmers manual
[NASA-TP-2515] N86-21614
Data analysis of the NOAA-GIT (National Oceanic and Atmospheric Administration-Georgia Institute of Technology) millimeter-wave propagation experiment near Faltville, Illinois
[AD-A161722] N86-21733
A diffuser heat transfer and erosion code
[AD-A162436] N86-21802
The evolution of a wave train in a three-dimensional boundary layer
[FFA-TN-1985-54] N86-21809
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921
Controlled impact demonstration airframe bending bridges N86-21943
The LATDYN user's manual
[NASA-TM-87635] N86-21953
Comparison of manually produced and automated cross country movement maps using digital image processing techniques
[NASA-CR-176653] N86-21969
Study of mechanisms of ionic transport in crystalline and glassy solid electrolytes N86-21976
A graphical debugger for concurrent Ada programs N86-22147
A computer program to calculate the resistivity of a thin film deposited on a conductive substrate from four-point probe measurements
[NASA-TM-87262] N86-22150
The SIMRAND methodology: Theory and application for the simulation of research and development projects
[NASA-CR-176663] N86-22153
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163
Artificial intelligence and its use in cost type analyses with and example in cost performance measurement
[AD-A161817] N86-22168
Temporal reasoning and default logics
[AD-A162447] N86-22170
Specification technology guidelines
[AD-A162655] N86-22178
GETWRD package update: New features and modifications to the GETWRD package
[AD-A162698] N86-22179
POLYGON: An interactive program for constructing and editing the geometries of polygons using a color graphics terminal
[DE86-001419] N86-22185
Numerical methods for differential equations
[AD-A162722] N86-22218
COMPUTER STORAGE DEVICES
Reducing memory references via effective register usage
[AD-A161352] N86-21760
Time and frequency dependent behavior of a two dimensional electron gas at long wavelengths
[AD-A162546] N86-21773
COMPUTER SYSTEMS PROGRAMS
Spacecraft propulsion systems mass modelling study: Assumptions and definitions N86-21576
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
Specification technology guidelines
[AD-A162655] N86-22178
The Statistical Analysis Program Package (SAPP): A special data analysis program
[OEFZS-4326] N86-22248
COMPUTER TECHNIQUES
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437

Applications of computers as an aid to decision-making in Air Force System Program Offices
[AD-A161784] N86-22442
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

COMPUTERIZED SIMULATION
Investigation of solid plume simulation criteria to produce flight plume effects on multibody configuration in wind tunnel tests
[NASA-TP-2569] N86-21507
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Spread spectrum acquisition and tracking
[AD-A162442] N86-21734
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits
[AD-A161371] N86-21761
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
Volumetric trochoidal gas compressor for use as a heat pump
[PB86-102720] N86-21871
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
Simulations among multidimensional iterative arrays, iterative tree automata, and alternating turning machines
[AD-A162661] N86-22142
ASIM (Automated interactive simulation modeling system) VAX version user's manual
[AD-A161556] N86-22162
An assessment of Ada's suitability in general purpose programming applications
[AD-A161715] N86-22165
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
An analysis and simulation of the CRAY X-MP memory system
[AD-A162769] N86-22190
Robust adaptive control
[AD-A161349] N86-22192
On the boundary treatment in spectral methods for hyperbolic systems
[NASA-CR-178055] N86-22204
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Airport-Noise Levels and Annoyance Model (ALAMO) user's guide
[NASA-TM-87695] N86-22304
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380
Numerical simulation of an accelerator injector
[DE86-001572] N86-22385
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431
A computer simulation study of the microscopic structure of a typical current sheet in the solar wind
[AERONOMICA-ACTA-A-301-1985] N86-22533
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

COMPUTERS
Bimodal optical computer
[AD-A161399] N86-22187

CONCENTRATION (COMPOSITION)
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670

CONCENTRATORS
Thermal deformation of concentrators in an axisymmetric temperature field
[NASA-TM-77935] N86-21977

CONDUCTION ELECTRONS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

CONFERENCES
Proceedings of Cabin Safety Conference and Workshop held on 11-14 December 1984
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Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
Solar energy 85: Resources, technologies, economics — conferences
[ESA-SP-240] N86-21983
Proceedings of the 12th Annual Meeting on Atmospheric Studies by Optical Methods
[AP-23] N86-22027
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
On Mini Conference on Order Restricted Inference held at Iowa University Campus on 11-13 September 1985
[AD-A162478] N86-22242
The 25th Conference on Statistical Theory and Practice held at the University of Wisconsin, Madison on 29-31 May 1985
[AD-A162645] N86-22244
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461

CONFIDENCE LIMITS
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239

CONFIGURATION MANAGEMENT
Reconfigurable work station for a video display unit and keyboard
[NASA-CASE-MFS-26009-1SB] N86-22114

CONGRESSIONAL REPORTS
NASA's long range plans
[GPO-55-035] N86-22435
Authorizing appropriations for Landsat commercialization
[HR-REPT-99-177] N86-22448

CONGRUENCES
The RANDOM computer program: A linear congruential random number generator
[NASA-CR-176664] N86-22152

CONICAL BODIES
Electrical cone connector
[AD-D011982] N86-21781
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431

CONICAL FLOW
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512

CONJUGATE GRADIENT METHOD
Parallel implementation of preconditioned conjugate gradient methods
[AD-A161988] N86-22186
Analysis of a linear antenna two wavelengths long: Consideration of options
[AD-A162799] N86-22222

CONJUGATES
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems
[AD-A161550] N86-21730

CONSERVATION
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772

CONSTANTS
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239

CONSTITUTIVE EQUATIONS
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952

CONSTRAINTS
Limiting performance of nonlinear systems with applications to helicopter vibration control
[AD-A161457] N86-21551
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239

CONSTRUCTION
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673

CONTAINERLESS MELTS
Quasi-containerless glass formation method and apparatus
[NASA-CASE-MFS-28090-1] N86-21684

CONTAMINANTS
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

CONTAMINATION
Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

CONTINUOUS WAVE LASERS
Single-frequency CW lasing in injection laser based on terraced heterostructure with external dispersion cavity N86-22274

CONTINUUM MECHANICS
Burger's equation and shock waves propagating within liquid-gas mixtures
[AD-A161554] N86-21800
Finite element method analysis of nonlinear continua using stochastic equivalent linearization technique N86-22202

CONTRACTION
The electroplating of laminated chromium
[AD-A162751] N86-21671

CONTROL SIMULATION
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236

CONTROL STABILITY
Principal direction alignment, a geometric framework for the computer solution to the mu-problem — control theory
[OUEL-1595/85] N86-22198
Necessary and sufficient stability conditions for the case of dependent additive perturbations — control system uncertainty
[OUEL-1596/85] N86-22199
Robustness of multivariable feedback systems: Analysis and optimal design
[OUEL-1601/85] N86-22201
Normality scaling and eigenvalue inclusion regions — multivariable feedback systems
[OUEL-1594/85] N86-22249

CONTROL SURFACES
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

CONTROL SYSTEMS DESIGN
Graphical techniques to assist in pointing and control studies of orbiting spacecraft
[NASA-TP-2575] N86-21559
Tutorials on self-tuning control. Volume 1: Introduction to self-tuning and adaptive control
[OUEL-1592/85-VOL-1] N86-22196
Tutorials on self-tuning control. Volume 2: Automatic tuning of PID regulators
[OUEL-1593/85-VOL-2] N86-22197
Robustness of multivariable feedback systems: Analysis and optimal design
[OUEL-1601/85] N86-22201

CONTROL THEORY
Parameter optimization and attitude stabilization of a flexible spacecraft
[INPE-3680-PRE/830] N86-21572
Robust adaptive control
[AD-A161349] N86-22192
On a theory of control for linear systems over rings and nonlinear/time-varying systems
[AD-A162680] N86-22194
Tutorials on self-tuning control. Volume 1: Introduction to self-tuning and adaptive control
[OUEL-1592/85-VOL-1] N86-22196
Tutorials on self-tuning control. Volume 2: Automatic tuning of PID regulators
[OUEL-1593/85-VOL-2] N86-22197
Necessary and sufficient stability conditions for the case of dependent additive perturbations — control system uncertainty
[OUEL-1596/85] N86-22199

CONTROL UNITS (COMPUTERS)
The Army Research Institute Unit Performance Research and Development Center
[NASA-CR-176618] N86-21706
A decision support system for cost-effectiveness analysis for control and security of computer systems
[AD-A161388] N86-22134

CONTROLLABILITY
Parameter optimization and attitude stabilization of a flexible spacecraft
[INPE-3680-PRE/830] N86-21572

CONTROLLERS
Automated generation of microcontrollers
[AD-A162668] N86-21775

Computer Controller Optical Surfacing (CCOS) lap pressure control system
[AD-D011985] N86-21805
Low-noise phase/frequency detector
[AD-A161394] N86-21821
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
Reconfigurable work station for a video display unit and keyboard
[NASA-CASE-MFS-26009-1SB] N86-22114
Adaptive control of multivariable systems
[AD-A162795] N86-22195

CONVECTIVE FLOW
Bifurcation and stability of complex flows
[AD-A161405] N86-21799

CONVECTIVE HEAT TRANSFER
Experimental study of shear flows and convective heat transfer characteristics of granular materials N86-21785
An experimental study of convective heat transfer, friction, and rheology for non-Newtonian fluids: Polymer solutions, suspensions of fibers, and suspensions of particulates N86-21786

CONVERGENCE
Exact dynamically convergent calculations of the frequency-dependent density response function
[AD-A162570] N86-22217

COOLING
Microcellular foams via phase separation
[DE86-000784] N86-21699
Research and development of a high average power photoprocessing laser system N86-21840
Intense beams of cold atoms for laser spectroscopy N86-22282

COOLING SYSTEMS
Basic principles of the Stirling cycle N86-21717

COORDINATES
A study of singularities in boundary-fitted coordinate systems
[AD-A161756] N86-22214

COPOLYMERIZATION
Improved amphoteric ion exchanger and its manufacturing method
[DE86-001606] N86-21836

COPPER
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
Spatial, temporal and energy characteristics of copper-vapor laser radiation N86-22272
Wavelength switching in copper-vapor lasers N86-22275
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428

COPPER ALLOYS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

COPPER CHLORIDES
Complexes of nitrocellulose with cupric chloride
[AD-A162519] N86-21589

CORONAL HOLES
A search for outflows from X-ray bright points in coronal holes
[NASA-CR-176647] N86-22458

CORONAS
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278

CORRELATION
Radiative interactions in transient energy transfer in gaseous systems
[NASA-CR-176644] N86-21798
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828
The aging correlation (RH + t): Relative humidity (%) + temperature (deg C)
[NASA-CR-176661] N86-21980
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236

CORROSION
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693

CORROSION PREVENTION
Corrosion and corrosion prevention in gas turbines
[NASA-TM-77924] N86-21544

CORROSION RESISTANCE
Quantitative methods for the chemical analysis of sealing glasses
[DE86-001662] N86-21702

CORROSION TESTS
Corrosion and corrosion prevention in gas turbines
[NASA-TM-77924] N86-21544

COSMIC RAY SHOWERS
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536

COSMIC X RAYS
The X-ray background --- galactic radiation N86-22463
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483
Objective crystal spectrometer (OXS) for imaging extended cosmic X-ray sources N86-22502

COSMOLOGY
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531

COST ANALYSIS
Artificial intelligence and its use in cost type analyses with and example in cost performance measurement
[AD-A161817] N86-22168
Exploring the utility of a staged technology assessment process, volume 1
[PB86-109402] N86-22453

COST EFFECTIVENESS
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
A decision support system for cost-effectiveness analysis for control and security of computer systems
[AD-A161388] N86-22134
Risk and the right model
[AD-A161757] N86-22440
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

COST ESTIMATES
Jet engine operating and support cost estimating relationship development
[AD-A161683] N86-21547
Risk and the right model
[AD-A161757] N86-22440

COULOMB POTENTIAL
A solvable model for localized adsorption in a Coulomb system
[AD-A162697] N86-21776

COUNTERS
A conditional sampling module for the TSI laser Doppler anemometer counter processor
[AD-A161555] N86-21823

COUPLED MODES
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
Analytical applications of ICP-FTS
[DE86-000819] N86-22409

COUPLING COEFFICIENTS
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552

COVALENT BONDS
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425

COVARIANCE
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779
Extraction of information from major element chemical analyses of lunar basalts N86-22514

CRACK CLOSURE
Variables controlling fatigue crack growth of short cracks
[NASA-TM-87208] N86-21661

CRACK INITIATION
Crack initiation and microstructure in tungsten carbide-cobalt composites N86-21651
Fatigue crack growth under general-yielding cyclic-loading
[NASA-CR-175049] N86-21951
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963

CRACK PROPAGATION
Boundary layer effects in nearly incompressible cracked bodies N86-21605
Influence of damage on mechanical performance of woven laminates at low temperature N86-21606
Effect of additional heat treatment of 2024-T3 on the growth of fatigue crack in air and in vacuum
[NASA-TM-77984] N86-21657
Variables controlling fatigue crack growth of short cracks
[NASA-TM-87208] N86-21661
Asymptotic analysis of a mode 1 crack propagating steadily in a deformation theory material
[AD-A161770] N86-21689
Plastic deformation on the crack line in an elastic perfectly-plastic material N86-21881
Fatigue crack growth under general-yielding cyclic-loading
[NASA-CR-175049] N86-21951
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960
Thermal mechanical fatigue crack growth. An application for fracture mechanics analyses of gas turbine engine disks
[AD-A162634] N86-21962
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965

CRACK TIPS
Plastic deformation on the crack line in an elastic perfectly-plastic material N86-21881

CRACKING (FRACTURING)
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965

CRACKS
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques
[AD-A162746] N86-21710

CRASH LANDING
Aircraft accident report: Galaxy Airlines, Inc., Lockheed Electra-L-188C, N5532, Reno, Nevada, January 21, 1985
[PB86-910401] N86-21526

CRASHES
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
CID overview N86-21934
CID flight/impact N86-21935
NASA experiments on the B-720 structure and seats N86-21936
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
Data reduction, management, and analysis software for CID N86-21938
NASA seat experiment and occupant responses N86-21939
Structural loads preliminary results N86-21940
Digital filtering and acceleration pulse interpretation N86-21941
Preliminary floor, seat, and dummy data N86-21942
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
Controlled impact demonstration on-board (interior) photographic system N86-21946
CID-720 aircraft high-environment flight instrumentation system N86-21947
Impact dynamics instrumentation N86-21948
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949

CRASHWORTHINESS
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
CID overview N86-21934
NASA experiments on the B-720 structure and seats N86-21936
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
Data reduction, management, and analysis software for CID N86-21938
Structural loads preliminary results N86-21940
Controlled impact demonstration airframe bending bridges N86-21943
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949

CRATERS
Regolith erosion and regolith mixing at the Apollo 15 site on the moon N86-22511

The Apennine Bench Formation revisited N86-22526
CRAY COMPUTERS
An analysis and simulation of the CRAY X-MP memory system
[AD-A162769] N86-22190
CREEP PROPERTIES
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide
[AD-A161455] N86-21955
CREW PROCEDURES (INFLIGHT)
Aircraft accident report: Galaxy Airlines, Inc., Lockheed Electra-L-188C, N5532, Reno, Nevada, January 21, 1985
[PB86-910401] N86-21526
CREW STATIONS
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
CRITERIA
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
CRITICAL FREQUENCIES
Critical damping in complex structures and control systems N86-21927
CROSS CORRELATION
A real-time programmable optical correlator
[AD-D011990] N86-22397
CROSS RELAXATION
YAG:Er3+ cross-relaxation laser N86-22277
CROSSINGS
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240
CROSSLINKING
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692
CRUISE MISSILES
The evolution of the cruise missile
[AD-A162646] N86-21538
CRYOGENIC COOLING
Basic principles of the Stirling cycle N86-21717
CRYOGENIC EQUIPMENT
Design and fabrication of a long-life Stirling cycle cooler for space appliction. Phases 1 and 2: Engineering model
[NASA-CR-175288] N86-21714
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715
A small free-piston Stirling refrigerator N86-21716
CRYOGENIC WIND TUNNELS
Thermal sensing of cryogenic wind tunnel model surfaces
[NASA-CR-176641] N86-21557
CRYOGENICS
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
CRYOSTATS
Inelastic scattering in condensed matter with high intensity Moessbauer radiation
[DE86-002461] N86-22321
CRYSTAL DEFECTS
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415
CRYSTAL GROWTH
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396
CRYSTAL OPTICS
The XMM imaging Bragg spectrometer with a doubly curved crystal N86-22493
Objective crystal spectrometer (OXS) for imaging extended cosmic X-ray sources N86-22502
CRYSTAL STRUCTURE
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
Structure and electrical properties of strontium zipconate N86-21751
Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851
A study on inclusion formation mechanism in alpha-LiIO sub 3 crystals
[NASA-TM-77943] N86-22417
CRYSTAL SURFACES
Void initiation preceding ductile fracture in polycrystalline titanium
[AD-A161821] N86-21668
Metal-insulator transition on the Ge(001) surface N86-22327
Studies of the Ta(110) surface and hydrogen on Ta(110) N86-22342
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Oxidation of GaSe(110) cleaved surface N86-22345
CRYSTALLIZATION
Apollo 15 mare units and their petrogenesis N86-22512
CRYSTALLOGRAPHY
Characterization of plasma-sprayed ferrite coatings N86-21854
CRYSTALS
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
Modulation of IR lasers by semiconducting plasma N86-22256
YAG:Er3+ cross-relaxation laser N86-22277
CUBES (MATHEMATICS)
Dictionary machines for cube-class networks
[AD-A161393] N86-22136
CUMULATIVE DAMAGE
Life prediction for composite laminates using critical element concepts N86-21608
CURING
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11536-1SB] N86-21590
Modeling the curing process of thick-section autoclave cured composites N86-21600
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-2] N86-21675
Aminophenoxycyclotriphosphazene cured epoxy resins and the composites, laminates and structures thereof
[NASA-CASE-ARC-11548-1] N86-21686
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
CURRENT DENSITY
The electroplating of laminated chromium
[AD-A162751] N86-21671
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
CURRENT SHEETS
A computer simulation study of the microscopic structure of a typical current sheet in the solar wind
[AERONOMICA-ACTA-A-301-1985] N86-22533
CURVE FITTING
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163
CURVES (GEOMETRY)
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163
CYANIDES
Vertical distribution of acetonitrile in the atmosphere
[AERONOMICA-ACTA-A-300-1985] N86-22021
CYCLIC COMPOUNDS
Neighboring group participation in solvolysis of organosulfur and related compounds
[AD-A161458] N86-21587
CYCLIC LOADS
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
Fatigue crack growth under general-yielding cyclic-loading
[NASA-CR-175049] N86-21951
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965
CYCLOHEXANE
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
CYCLOTRON FREQUENCY
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382
CYCLOTRON RESONANCE DEVICES
High voltage K sub a -band gyrotron experiment
[AD-A161686] N86-21845
CYLINDRICAL BODIES
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques
[AD-A162746] N86-21710
Effects of waveguide modes on the scattering of a finite tubular cylinder
[AD-A161500] N86-21729
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
Finite element analysis of two cylindrical expansion problems involving near incompressible material behaviour
[OUEL-1580/85] N86-22227
Determination of optical inhomogeneity of cylindrical bodies by light beam deflection N86-22284
CYSTEINE
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089
CZOCHRALSKI METHOD
KNbO3 single crystal growth by the radio frequency heating Czochralski method
[NASA-TM-77944] N86-22416

D

DAMAGE
Influence of damage on mechanical performance of woven laminates at low temperature N86-21606
State-of-the-art review on composite material fatigue/damage tolerance
[FAA/CT-85/7] N86-21615
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
DAMAGE ASSESSMENT
Response of thick, notched laminates subjected to tension-compression cyclic loads N86-21610
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
DAMPERS
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
DAMPING
Damping behavior of metal matrix composites N86-21900
A comparison of measured spacecraft modal damping values N86-21903
Flexible structure control in the frequency domain N86-21929
Passively damped joints for advanced space structures N86-21930
Interactions between unstable baroclinic and resonant, topographic waves in a two-layer model of the atmosphere N86-22055
DAMPING TESTS
Experimental measurement of material damping for space structures N86-21887
Damping measurement by dynamic stiffness methods N86-21902
DATA ACQUISITION
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories)
[AD-A161664] N86-21537
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
CID-720 aircraft high-environment flight instrumentation system N86-21947
Impact dynamics instrumentation N86-21948
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22061
Contact X-ray microscopy of biological materials N86-22370
Optical acquisition, image and data compression
[AD-A161650] N86-22393
DATA BASE MANAGEMENT SYSTEMS
A protection model for distributed data base management systems N86-22128
Advanced Technology Unit Training and Management System (ATUTMS). User's guide
[NASA-CR-176643] N86-22130
A decision support system for cost-effectiveness analysis for control and security of computer systems
[AD-A161388] N86-22134
View based, global design of access structures for relational databases N86-22144
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
Representation of urban districts in a geographical information system
[PB86-109451] N86-22455
DATA BASES
Data analysis of the NOAA-GIT (National Oceanic and Atmospheric Administration-Georgia Institute of Technology) millimeter-wave propagation experiment near Faltville, Illinois
[AD-A161722] N86-21733
Machinability data bases for metal cutting
[AD-A161646] N86-21860

EPA (Environmental Protection Agency) oxidant model: Description and evaluation plan
[PB86-103090] N86-22016
Dictionary machines for cube-class networks
[AD-A161393] N86-22136
Geonames processing system functional design specification. Volume 5: Performance specifications
[AD-A162571] N86-22141
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Computer-Based Instruction (CBI): Considerations for a user-oriented technology data base
[AD-A161776] N86-22167
Geonames processing system functional design specification. Volume 3: Advanced type placement
[AD-A162552] N86-22175
The use of quantitative databases in Aladin, an alloy design system
[AD-A162555] N86-22176

DATA COMPRESSION
Advanced mail systems technology. Executive summary and appendices A-G
[AD-A161003] N86-22131
Optical acquisition, image and data compression
[AD-A161650] N86-22393

DATA CORRELATION
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944

DATA MANAGEMENT
The Army Research Institute Unit Performance Research and Development Center
[NASA-CR-176618] N86-21706
Data reduction, management, and analysis software for CID N86-21938
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
Low cost management of replicated data
[AD-A162771] N86-22447

DATA PROCESSING
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
Data analysis of the NOAA-GIT (National Oceanic and Atmospheric Administration-Georgia Institute of Technology) millimeter-wave propagation experiment near Faltville, Illinois
[AD-A161722] N86-21733
Digital filtering and acceleration pulse interpretation N86-21941
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001
User's guide for the multiple airshed (MASH) model
[PB86-100146] N86-22014
Geonames processing system functional design specification. Volume 5: Performance specifications
[AD-A162571] N86-22141
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
Low cost management of replicated data
[AD-A162771] N86-22447

DATA PROCESSING EQUIPMENT
A conditional sampling module for the TSI laser Doppler anemometer counter processor
[AD-A161555] N86-21823
Multi-Input/Multi-Output sensitivity points tuning
[AD-A161641] N86-22193

DATA REDUCTION
Data reduction, management, and analysis software for CID N86-21938
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data
[NASA-CR-176660] N86-21970
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001

DATA SAMPLING
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944

DATA STORAGE
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
Low cost management of replicated data
[AD-A162771] N86-22447

DATA STRUCTURES
Methods of conceptual clustering and their relation to numerical taxonomy
[AD-A160221] N86-22191

DATA TRANSMISSION
Development of improved broadband cable system communications
[AD-A161559] N86-21766

DAWN CHORUS
X-ray microbursts and VLF chorus
[AD-A162531] N86-22049

DAYGLOW
Analysis of nitric oxide fluorescence bands from high latitude rocket observations of the thermospheric dayglow N86-22018

DC 9 AIRCRAFT
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525

DEATH
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525

DECAY
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358

DECISION MAKING
Decision support system for ASD (Aeronatical Systems Division) program managers
[AD-A161690] N86-22137
The SIMRAND methodology: Theory and application for the simulation of research and development projects
[NASA-CR-176663] N86-22153
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169
An optimal repartitioning decision policy
[NASA-CR-178035] N86-22250
Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437
Risk and the right model
[AD-A161757] N86-22440
A methodology for applying bar code technology to Aircraft Maintenance Unit support sections
[AD-A161783] N86-22441
Applications of computers as an aid to decision-making in Air Force System Program Offices
[AD-A161784] N86-22442
Exploring the utility of a staged technology assessment process, volume 1
[PB86-109402] N86-22453
Exploring the utility of a staged technology assessment process, volume 2
[PB86-109410] N86-22454

DECISION THEORY
A decision support system for cost-effectiveness analysis for control and security of computer systems
[AD-A161388] N86-22134

DECODING
Sequential decoding for multiple access channels
[AD-A162630] N86-21738
An algebraic syndrome decoding technique for certain convolutional codes
[AD-A162636] N86-22177

DECOMPOSITION
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220

DEFENSE PROGRAM
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

DEFLAGRATION
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711

DEFORMATION
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
Void initiation preceding ductile fracture in polycrystalline titanium
[AD-A161821] N86-21668
Contribution of bending energy losses to the apparent tear energy
[AD-A162775] N86-21696
Shear stress concentration near the edge of a thin film deposited on a substrate N86-21880
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420

DEGRADATION
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960

DEGREES OF FREEDOM
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886
Critical damping in complex structures and control systems N86-21927
Complexity of the generalized mover's problem
[AD-A161378] N86-22209

DELAMINATING
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Analysis of aluminum/aramid-epoxy hybrid laminates N86-21595
Composite laminate free edge reinforcement concepts N86-21601
Viscoelastic behavior and life-time predictions N86-21602
Influence of damage on mechanical performance of woven laminates at low temperature N86-21606
Delamination growth in composite materials
[NASA-CR-178066] N86-21618

DELAY
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635

DELTA WINGS
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522

DENSIMETERS
Determination of Tri-n-Butyl Phosphate (TBP) in the TBP-mVarsol-HNO3 system using precision densimetry
[DE86-001607] N86-21832

DENSITY DISTRIBUTION
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023

DEOXYRIBONUCLEIC ACID
Lymphocyte activation - regulatory substances
[AD-A162683] N86-22087

DEPOSITION
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
A computer program to calculate the resistivity of a thin film deposited on a conductive substrate from four-point probe measurements
[NASA-TM-87262] N86-22150
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431

DESERTS
Desert studies: A global view
[AD-A161453] N86-21971

DESIGN ANALYSIS
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827

DESORPTION
Photon desorption studies of synchrotron materials N86-22339
Photon stimulted desoprtion of ions from polymer surfaces N86-22367

DETECTION
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Coincidental chemical signature identifier
[AD-A161269] N86-21637
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
Edge detection
[AD-A162662] N86-22395
Thin-film chemical sensors based on electron tunneling
[NASA-CR-176662] N86-22418

DETONATION
An eight-inch diameter, heavily confined card gap test
[AD-A161557] N86-21705

Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712
DETONATION WAVES
The influence of initial and boundary conditions on gaseous detonation waves
[AD-A162631] N86-21803
DEUTERIUM
A study of orientational ordering in solid deuterium N86-22315
Radiative neutron capture by deuterum N86-22325
DIATOMIC MOLECULES
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/)
[DE86-001480] N86-22322
DICHROISM
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
UV-VUV circular dichroism spectrometer N86-22352
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356
U9B: Ultraviolet biophysics N86-22357
DICTIONARIES
Dictionary machines for cube-class networks
[AD-A161393] N86-22136
DIELECTRIC PROPERTIES
An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380
DIELECTRICS
Low loss dielectrics with controllable values of specific permittivity — microwave circuit fillers
[DRIC-T-7632] N86-21752
DIESEL ENGINES
Fuel property effects on the unaided cold starting of a two-cycle diesel engine
[AD-A162658] N86-21708
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
Transformation toughened ceramics for the heavy duty diesel engine technology program, phase 2
[NASA-CR-175054] N86-22451
DIESEL FUELS
An experimental evaluation of the effects of selected organic compounds on the formation of insolubles in diesel fuels
[AD-A161323] N86-21586
Fuel property effects on the unaided cold starting of a two-cycle diesel engine
[AD-A162658] N86-21708
DIETS
Mechanisms of bioenergetic homeostasis during exercise: A general model
[AD-A161678] N86-22098
DIFFERENCE EQUATIONS
On conservative difference schemas
[AD-A162798] N86-22221
Investigation of perturbation techniques for nonlinear difference equations and other related problems
[DE86-001162] N86-22224
DIFFERENTIAL EQUATIONS
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
The dynamics of heat transfer in a turbulent pipe flow, part 2
[OEFZS-4325-PT-2] N86-21808
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
Systematics of strongly self-dominant higher order differential equations based on the painleve analysis of their singularities
[AD-A162545] N86-22216
Numerical methods for differential equations
[AD-A162722] N86-22218
On conservative difference schemas
[AD-A162798] N86-22221
DIFFRACTION
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
X-ray lithography: Beamline U6 N86-22332
DIFFUSION
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Point defects and dopant diffusion in silicon N86-21743
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
Diffusion and defect characterization studies of mercury cadmium telluride
[AD-A162644] N86-22429
DIFFUSION COEFFICIENT
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
DIFFUSION THEORY
Multiple time step partitioned integrators for finite element equations N86-22203
DIGITAL DATA
Data reduction, management, and analysis software for CID N86-21938
Geonames processing system functional design specification. Volume 3: Advanced type placement
[AD-A162552] N86-22175
DIGITAL FILTERS
Digital filtering and acceleration pulse interpretation N86-21941
DIGITAL SYSTEMS
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Low-noise phase/frequency detector
[AD-A161394] N86-21821
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Functional test generation of digital LSI/VLSI systems using machine symbolic execution technique N86-22146
Minimization of a six variable boolean function
[AD-A161718] N86-22166
Geonames processing system functional design specification. Volume 3: Advanced type placement
[AD-A162552] N86-22175
DIGITAL TECHNIQUES
Digital filtering and acceleration pulse interpretation N86-21941
DIMENSIONAL ANALYSIS
Existence of random variables with values in the dual of a nuclear space
[AD-A161343] N86-22233
DIMENSIONAL STABILITY
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
DIMENSIONS
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
DIMERIZATION
Metal-insulator transition on the Ge(001) surface N86-22327
DIMERS
Measurement of the dissociation energies of gas phase neutral dimers by a photoionization technique N86-22360
DIMETHYLHYDRAZINES
Experimental studies on the reaction kinetics of 1,1-dimethylhydrazine and oxygen
[NASA-TM-77947] N86-21630
DIODES
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
DIOXIDES
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
DIPOLE ANTENNAS
Analysis of a linear antenna two wavelengths long: Consideration of options
[AD-A162799] N86-22222
DIRECT CURRENT
The electroplating of laminated chromium
[AD-A162751] N86-21671
DISCONTINUITY
Investigation of planar waveguides and components for millimeter-wave integrated circuits
[AD-A161400] N86-21763
DISCRETE FUNCTIONS
M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
DISEASES
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
DISKS (SHAPES)
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662
DISPLACEMENT
A small free-piston Stirling refrigerator N86-21716
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21694
DISPLAY DEVICES
The effects of color-coding in geosit displays. 1: Color as a redundant code
[AD-A161107] N86-22106
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
Architectural elements for bitmap graphics N86-22127
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Development and use of the Life Cycle Cost In Design computer program (LCCID)
[AD-A162522] N86-22174
DISSOCIATION
Electron microscopic determination of the metastable dissociation region in the system Li sub 2SiO3-SiO sub 2
[NASA-TM-77980] N86-21681
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Measurement of the dissociation energies of gas phase neutral dimers by a photoionization technique N86-22360
DISTANCE
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
The role of the topological distance matrix in chemistry
[AD-A162523] N86-22252
DISTANCE MEASURING EQUIPMENT
Minimum operational performance standards for airborne Distance Measuring Equipment (DME) operation within the radio frequency range of 960-1215 megahertz
[RTCA/DO-189] N86-21542
DISTRIBUTED PARAMETER SYSTEMS
Distributed piezoelectric-polymer active vibration control of a cantilever beam N86-21924
Critical damping in complex structures and control systems N86-21927
DISTRIBUTED PROCESSING
Complexity results in VLSI and distributed computing N86-21744
A protection model for distributed data base management systems N86-22128
ASIM (Automated interactive simulation modeling system) VAX version user's manual
[AD-A161556] N86-22162
Low cost management of replicated data
[AD-A162771] N86-22447
DISTRIBUTION (PROPERTY)
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206
DISTRIBUTION FUNCTIONS
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382
DIVERTERS
Plasma flows in divertor regions of Vint-20 single-pass torsatron N86-22296
DIVING (UNDERWATER)
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
DO-28 AIRCRAFT
The icing research aircraft DO28, D-IFMP of DFVLR, and its measuring equipment
[DFVLR-MITT-85-12] N86-22064
DOCUMENTATION
Development and use of the Life Cycle Cost In Design computer program (LCCID)
[AD-A162522] N86-22174
Scientific and technical information output of the Langley Research Center for Calendar Year 1985
[NASA-TM-87655] N86-22445
Exploring the utility of a staged technology assessment process, volume 1
[PB86-109402] N86-22453
DOMAINS
Flexible structure control in the frequency domain N86-21929
DOMES (STRUCTURAL FORMS)
Airborne tracking Sun photometer apparatus and system
[NASA-CASE-ARC-11622-1] N86-21982

DOMESTIC ENERGY
Passive and hybrid solar systems N86-21986
DOPED CRYSTALS
Point defects and dopant diffusion in silicon N86-21743
The effect of contacts on the counting characteristics of heavily doped n-type cadmium telluride N86-21746
Performance limits of scaled CMOS analog ICs N86-21748
DOPPLER RADAR
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
Weather radar studies
[AD-A161622] N86-22061
Studies of complex-terrain flows using acoustic remote sensors
[PB86-100138] N86-22068
DOSIMETERS
Fabricate, calibrate and test a dosimeter for integration into the CRRES (Combined Release and Radiation Effects Satellite)
[AD-A161695] N86-21825
DRIFT (INSTRUMENTATION)
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
DRIFT RATE
A tunneling microscope for operation in air or fluids
[AD-A161325] N86-21819
DRILLING
Vertically operating flight vehicle for drilling and agricultural use
[NASA-TM-77713] N86-21535
DROP TESTS
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
DROP TOWERS
Drop tube technical tasks
[NASA-CR-178741] N86-21564
DROUGHT
Periodicities in the All India Rainfall series and in the drought and flood area indices
[INPE-3717-PRE/853] N86-22057
Stochastic analysis of drought phenomena
[AD-A160947] N86-22060
DRUGS
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100
DRY FRICTION
Characteristics of dry friction damping N86-21889
DUCTILITY
Void initiation preceding ductile fracture in polycrystalline titanium
[AD-A161821] N86-21668
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
DUMMIES
Preliminary floor, seat, and dummy data N86-21942
Impact dynamics instrumentation N86-21948
DURABILITY
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
DYE LASERS
Generation of picosecond pulses in monopulse-pumped dye lasers N86-22271
DYES
Investigation of fluorescence kinetics of dyes by parametric frequency conversion N86-22289
DYNAMIC CHARACTERISTICS
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
Structural damping of shuttle orbiter and ascent vehicles N86-21904
On vibration damping analysis using the finite element method N86-21911
A parallel stack processor to reduce procedure-call overhead
[AD-A162494] N86-22140
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
Exact dynamically convergent calculations of the frequency-dependent density response function
[AD-A162570] N86-22217
Development of research tools to study structure and evolution in the intermediate altitude regime
[AD-A162707] N86-22376
DYNAMIC CONTROL
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865
Flexible structure control in the frequency domain N86-21929
DYNAMIC LOADS
Behaviour of fibre-reinforced composites under dynamic tension
[OUEL-1602/85] N86-21626
A design guide for damping of aerospace structures N86-21923
The LATDYN user's manual
[NASA-TM-87635] N86-21953
DYNAMIC MODELS
Dynamical plasmapause positions during the July 29-31/1977 storm period: A comparison of observations and time dependent model calculations
[AERONOMICA-ACTA-A-299-1985] N86-22020
Flow optimization in dynamic and continuous networks
[AD-A162493] N86-22172
DYNAMIC MODULUS OF ELASTICITY
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
DYNAMIC RESPONSE
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536
The dynamic response of composite beams to axial impact N86-21603
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
Damping applications in turbine engines N86-21888
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
Measured damping of shuttle acoustic test structures N86-21905
Average loss factors for use in statistical energy analysis N86-21906
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
Results of finite element analysis of damped structures N86-21912
Use of skin damping treatments to control airframe dynamic response for interior noise control N86-21919
Fracture control for fixed offshore structures
[AD-A162507] N86-21961
The effects of color-coding in geosit displays. 1: Color as a redundant code
[AD-A161107] N86-22108
DYNAMIC STABILITY
Dynamic characteristics of two 300 kW class dual keel space station concepts
[NASA-TM-87680] N86-21569
A design guide for damping of aerospace structures N86-21923
On a theory of control for linear systems over rings and nonlinear/time-varying systems
[AD-A162680] N86-22194
DYNAMIC STRUCTURAL ANALYSIS
Dynamic characteristics of two 300 kW class dual keel space station concepts
[NASA-TM-87680] N86-21569
Experimental measurement of material damping for space structures N86-21887
Damping measurement by dynamic stiffness methods N86-21902
Measured damping of shuttle acoustic test structures N86-21905
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
Vibration isolation of an elevator system N86-21914
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921
Flexible structure control in the frequency domain N86-21929
Equivalent plate analysis of aircraft wing box structures with general planform geometry
[NASA-TM-87697] N86-21954
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
DYNAMIC TESTS
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536
DYNAMO THEORY
Plasma processes in the excitation of Herbig-Haro objects
[TRITA-EPP-84-09] N86-22413

E

E REGION
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051
EAR
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
EARTH (PLANET)
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
EARTH ORBITAL ENVIRONMENTS
Surface analysis of space telescope material specimens
[NASA-CR-178712] N86-22460
EARTHQUAKE DAMAGE
Vibration isolation of an elevator system N86-21914
EARTHQUAKES
Earthquake light
[AD-A161385] N86-22042
ECHOES
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
ECOLOGY
Biomedical and environmental sciences at Oak Ridge National Laboratory
[DE86-001639] N86-22091
ECONOMETRICS
On measures of nonnormality of matrices
[FEW-167] N86-22253
ECONOMIC FACTORS
The other aspect of solar energy utilization. Solar technologies export enhancement: A central European point of view N86-21985
EDGE DISLOCATIONS
Apparatus for edge etching of semiconductor wafers
[NASA-TM-77998] N86-21720
EDGE LOADING
Shear stress concentration near the edge of a thin film deposited on a substrate N86-21880
EDGES
Composite laminate free edge reinforcement concepts N86-21601
Edge detection
[AD-A162682] N86-22395
EDITING
DP format of the drawing files
[AD-A162440] N86-22139
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
EDITING ROUTINES (COMPUTERS)
Advanced mail systems technology. Executive summary and appendices A-G
[AD-A161003] N86-22131
EDUCATION
Personality type analysis of Air Force Institute of Technology School of Systems and Logistics graduate degree 85S class using Myers-Briggs Type-Indicator
[AD-A161053] N86-22107
EFFICIENCY
Minimum operational performance standards for airborne Distance Measuring Equipment (DME) operation within the radio frequency range of 960-1215 megahertz
[RTCA/DO-189] N86-21542
Maintenance planning for the 1990's (initial planning)
[PB86-106010] N86-22065
EIGENVALUES
Normality scaling and eigenvalue inclusion regions --- multivariable feedback systems
[OUEL-1594/85] N86-22249
EKMAN LAYER
Interactions between unstable baroclinic and resonant, topographic waves in a two-layer model of the atmosphere N86-22055
EL NINO
Large scale precipitation variations over South America during the 1982-83 ENSO EVENT
[INPE-3676-PRE/827] N86-22059
ELASTIC BODIES
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101

ELASTIC DAMPING
Vibration Damping 1984 Workshop Proceedings
[AD-A152547] N86-21883
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21894
ELASTIC DEFORMATION
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
Thermally induced stresses and deformations in layered composite tubes N86-21598
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Asymptotic analysis of a mode 1 crack propagating steadily in a deformation theory material
[AD-A161770] N86-21689
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
ELASTIC PLATES
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
ELASTIC PROPERTIES
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
ELASTIC SCATTERING
Elastodynamic scattering by periodic surface indentations N86-21882
Inelastic scattering in condensed matter with high intensity Moessbauer radiation
[DE86-002461] N86-22321
Measurements of proton-proton and proton-antiproton elastic scattering at the European Center for Nuclear Research Intersecting Storage Rings N86-22324
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane
[AD-A162548] N86-22426
ELASTIC SHEETS
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
ELASTIC SHELLS
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
ELASTIC WAVES
Damping in metal-matrix composites: Measurement and modeling N86-21901
Ground response in alluvial basins due to seismic disturbances
[AD-A162467] N86-22047
ELASTODYNAMICS
Elastodynamic scattering by periodic surface indentations N86-21882
ELASTOMERS
Perfluoro (imidoylamidine) diamidines
[NASA-CASE-ARC-11402-3] N86-21582
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099
ELASTOPLASTICITY
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory
[AD-A161733] N86-21958
Finite element analysis of two cylindrical expansion problems involving near incompressible material behaviour
[OUEL-1580/85] N86-22227
ELECTRA AIRCRAFT
Aircraft accident report: Galaxy Airlines, Inc., Lockheed Electra-L-188C, N5532, Reno, Nevada, January 21, 1985
[PB86-910401] N86-21526
ELECTRIC BATTERIES
Controlled impact demonstration on-board (interior) photographic system N86-21946
ELECTRIC CHARGE
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
ELECTRIC CONNECTORS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Electrical cone connector
[AD-D011982] N86-21781
ELECTRIC CONTACTS
Claw grip contact probe for flat packs
[AD-D011997] N86-21782
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299
ELECTRIC CONTROL
A contribution to the digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[DFVLR-FB-85-55] N86-21553
ELECTRIC DISCHARGES
Surface discharge through an insulator in a vacuum
[NASA-TM-77936] N86-21756
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
ELECTRIC ENERGY STORAGE
Utility cycle testing of a 500-kWh zinc chloride battery at the Battery Energy Storage Test (BEST) Facility
[DE86-001598] N86-22002
ELECTRIC FIELDS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
Chemical preparation of high-field zinc oxide varistors
[DE86-001611] N86-21784
Atmospheric electric fields: A numerical approach
[INPE-3704-PRE/844] N86-22025
Analysis of a linear antenna two wavelengths long: Consideration of options
[AD-A162799] N86-22222
Modulation of IR lasers by semiconducting plasma N86-22256
Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423
ELECTRIC GENERATORS
Technology for Bayton-cycle powerplants using solar and nuclear energy
[NASA-TP-2558] N86-21577
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
ELECTRIC POTENTIAL
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
Atmospheric electric fields: A numerical approach
[INPE-3704-PRE/844] N86-22025
ELECTRIC POWER PLANTS
Utility cycle testing of a 500-kWh zinc chloride battery at the Battery Energy Storage Test (BEST) Facility
[DE86-001598] N86-22002
ELECTRIC POWER SUPPLIES
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
A pulsed magnetohydrodynamic generator with a superconducting magnetic system
[AD-A161812] N86-22405
ELECTRIC PROPULSION
A bibliography of electrothermal thruster technology, 1984
[NASA-TM-86998] N86-21578
ELECTRIC STIMULI
Vection-induced gastric dysrhythmias and motion sickness
[NASA-CR-176620] N86-22095
ELECTRICAL MEASUREMENT
Microvoltammetric electrodes
[AD-A161653] N86-21642
Electrical conductivity measurements in shock compressed liquid nitrogen
[DE86-001575] N86-21783
ELECTRICAL PROPERTIES
Electrical photosemiconducting and paramagnetic properties of polypyromellitimides
[NASA-TM-77975] N86-21627
Microvoltammetric electrodes
[AD-A161653] N86-21642
Interface structure and electronic properties of the titanium-silicon system N86-21749
Structure and electrical properties of strontium zipconate N86-21751
ELECTRICAL RESISTANCE
Optically triggered bulk device gunn oscillator
[AD-D011977] N86-21780
ELECTRICAL RESISTIVITY
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Electrical conductivity measurements in shock compressed liquid nitrogen
[DE86-001575] N86-21783
A computer program to calculate the resistivity of a thin film deposited on a conductive substrate from four-point probe measurements
[NASA-TM-87262] N86-22150
ELECTRO-OPTICAL PHOTOGRAPHY
Spectral imaging with a CID camera
[AD-A161608] N86-21824
ELECTRO-OPTICS
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Electrically excited phenomena in gas-phase devices
[AD-A161527] N86-21764
Quantum electronics in the UK, a National-Survey Conference
[AD-A161623] N86-21769
ELECTROCARDIOGRAPHY
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
ELECTROCATALYSTS
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643
ELECTROCHEMICAL CORROSION
Corrosion and corrosion prevention in gas turbines
[NASA-TM-77924] N86-21544
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670
The aging correlation (RH + t): Relative humidity (%) + temperature (deg C)
[NASA-CR-176661] N86-21960
ELECTROCHEMISTRY
Microvoltammetric electrodes
[AD-A161653] N86-21642
Extended abstracts, 36th International Society of Electrochemistry held at Salamanca, Spain on 23-28 September 1985
[AD-A162434] N86-21644
Lightweight nickel electrode for nickel hydrogen cells and batteries
[NASA-TM-87253] N86-21978
Correlations between electrochemical potentials and optical charge transfer energies in ruthenium bipyridine derivatives
[AD-A161668] N86-22317
ELECTRODES
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
Microvoltammetric electrodes
[AD-A161653] N86-21642
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
Analytical methods of electrode design for a relativistic electron gun
[DE86-001584] N86-22387
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
ELECTROFORMING
Electroform replication of grazing incidence X-ray optics — spaceborne telescopes N86-22491
ELECTROLYTES
Study of mechanisms of ionic transport in crystalline and glassy solid electrolytes N86-21976
ELECTROLYTIC CELLS
Electrolyte for lithium-inorganic non-aqueous rechargeable cell system and rechargeable cell system including said electrolyte
[AD-D011976] N86-21647
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
ELECTROMAGNETIC ABSORPTION
The measuring assembly for a primary standard absorbed dose calorimeter — high energy particle beams
[NPL-RS(EXT)-74] N86-21814

ELECTROMAGNETIC FIELDS
European Science Notes. Volume 39, number 12
[AD-A161069] N86-21721
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Influence of electromagnetic wave and wiggler fields inhomogeneity on a free-electron laser N86-22264
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299

ELECTROMAGNETIC INTERACTIONS
Investigations of the structure and electromagnetic interaction of few-body systems
[DE86-001659] N86-22323

ELECTROMAGNETIC PROPERTIES
Earthquake light
[AD-A161385] N86-22042

ELECTROMAGNETIC RADIATION
Relativistic effects during Compton interaction of strong electromagnetic radiation and optically thin layer of cold plasma N86-22295

ELECTROMAGNETIC SCATTERING
Effects of waveguide modes on the scattering of a finite tubular cylinder
[AD-A161500] N86-21729
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems
[AD-A161550] N86-21730
Space-frequency sampling criteria for electromagnetic scattering of a finite object
[AD-A162553] N86-21737

ELECTROMAGNETIC WAVE TRANSMISSION
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046

ELECTRON ACCELERATION
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380

ELECTRON ACCELERATORS
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377

ELECTRON ATTACHMENT
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

ELECTRON AVALANCHE
Plasma mechanicsm underlying high pressure gas breakdown N86-22298

ELECTRON BEAMS
Equilibrium states of charged electron beams and space charge compensation processes N86-22292
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
Numerical simulation of an accelerator injector
[DE86-001572] N86-22385
Recent progress of the advanced test accelerator
[DE86-001578] N86-22386

ELECTRON DECAY RATE
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

ELECTRON DENSITY (CONCENTRATION)
Rocket experiments for spectral estimation of electron density fine structure in the auroral and equatorial ionosphere and preliminary results
[NASA-CR-176648] N86-22026
Earthquake light
[AD-A161385] N86-22042
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051
Far infrared diagnostics of electron concentration in combustion MHD plasmas using interferometry and Faraday rotation N86-22401
Solar flare ionization in the mesosphere observed by coherent-scatter radar
[NASA-CR-176649] N86-22534

ELECTRON DISTRIBUTION
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Host materials for transition-metal ions with the ndN electronic configuration
[AD-A161782] N86-21846

ELECTRON ENERGY
Surface discharge through an insulator in a vacuum
[NASA-TM-77936] N86-21756
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities
[NAL-TR-866T] N86-22314
Electronic energy transfer among complex molecules N86-22316
Energy flow in van der Waals molecules N86-22361
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377

ELECTRON GAS
Time and frequency dependent behavior of a two dimensional electron gas at long wavelengths
[AD-A162546] N86-21773
Exact dynamically convergent calculations of the frequency-dependent density response function
[AD-A162570] N86-22217
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318

ELECTRON GUNS
Analytical methods of electrode design for a relativistic electron gun
[DE86-001584] N86-22387

ELECTRON IMPACT
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320

ELECTRON IRRADIATION
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415

ELECTRON MICROSCOPES
A study of precipitation and segregation on an atomic scale of 11at.percentCr-lat.percentMo heat resisting steel by atom-probe and TEM (Transmission Electron Microscope)
[AD-A161590] N86-21664
A tunneling microscope for operation in air or fluids
[AD-A161325] N86-21819

ELECTRON MICROSCOPY
Characterization of carbon fibers and fiber-matrix adhesion in composites N86-21612
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21663
Electron microscopic determination of the metastable dissociation region in the system Li sub 2SiO3-SiO sub 2
[NASA-TM-77980] N86-21681

ELECTRON MOBILITY
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Far infrared diagnostics of electron concentration in combustion MHD plasmas using interferometry and Faraday rotation N86-22401

ELECTRON PUMPING
Comparative analysis of optically and electronically pumped broadband excimer lasers N86-22273
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377

ELECTRON SCATTERING
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
Monte Carlo calculations on the direct cable drive due to gamma radiation
[AD-A161734] N86-22375
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408

ELECTRON SPECTROSCOPY
Deexcitation electron spectroscopy of free and coordinated CO N86-22363

ELECTRON STATES
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038
Surface states on simple metal surfaces N86-22328
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
Resonant photoemission studies of f-electron systems performed on station U14 N86-22369

ELECTRON TRAJECTORIES
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380

ELECTRON TRANSFER
Microvoltammetric electrodes
[AD-A161653] N86-21642
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

ELECTRON TRANSITIONS
Average collisional vibrational energy transfer quantities. The exponential model
[AD-A161814] N86-22319
Metal-insulator transition on the Ge(001) surface N86-22327
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349

ELECTRON TUBES
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043

ELECTRON TUNNELING
A tunneling microscope for operation in air or fluids
[AD-A161325] N86-21819
Thin-film chemical sensors based on electron tunneling
[NASA-CR-176662] N86-22418
Squeezable tunnel junctions
[AD-A161537] N86-22419

ELECTRONIC EQUIPMENT
NBS (National Bureau of Standards): Materials measurements
[NASA-CR-176646] N86-21648
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
Unclassified publications of Lincoln Laboratory, volume 10
[AD-A161752] N86-22446
Low cost management of replicated data
[AD-A162771] N86-22447

ELECTRONIC EQUIPMENT TESTS
A Pulse Amplifier/Discriminator (PAD) for single photon counting
[AP-24] N86-21838

ELECTRONIC MODULES
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584

ELECTRONIC SPECTRA
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343

ELECTRONS
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777

ELECTROPHORESIS
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

ELECTROPHOTOMETERS
An intensified photodiode array applied to one-dimensional auroral imaging N86-22040

ELECTROPLATING
The electroplating of laminated chromium
[AD-A162751] N86-21671

ELECTROTHERMAL ENGINES
A bibliography of electrothermal thruster technology, 1984
[NASA-TM-86998] N86-21578

ELEVATORS (LIFTS)
Vibration isolation of an elevator system N86-21914

ELLIPTICAL CYLINDERS
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack
[AD-A162407] N86-21801

EMBEDDED COMPUTER SYSTEMS
An assessment of Ada's suitability in general purpose programming applications
[AD-A161715] N86-22165

EMBRITTLEMENT
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673

EMERGENCY LIFE SUSTAINING SYSTEMS
Personnel emergency carrier vehicle
[NASA-CASE-KSC-11282-1] N86-22452

EMISSION SPECTRA
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635
Automated instrument for qualitative analysis of photographically recorded spectra
[DE86-001621] N86-21833
The nightglow hydroxl (8-3) band emission: A comparison of experiment and theory N86-22031
Kinetics and spectroscopy of high altitude infrared emissions
[PSI-G050-SR-207] N86-22032
Middle infrared emission studies in the upper atmosphere by rocket techniques N86-22033
Spectroscopic, kinetic, and dynamic experiments on atmospheric species
[AD-A162691] N86-22050

Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g) N86-22359
Measurement of atmospheric transmission over long paths in the infrared spectral region [AD-A161258] N86-22392
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry [AD-A162415] N86-22406

EMITTANCE
Evaluation of a standard test method for total hemispherical emittance of surfaces from 293K to 1673K [NASA-TM-87681] N86-21660

EMULSIONS
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel [AD-A161652] N86-21861

ENCAPSULATING
Chemical bonding technology: Direct investigation of interfacial bonds [NASA-CR-178657] N86-21584
Capsulation of moldings made from silicon ceramic material [NASA-TM-77933] N86-21680

ENERGETIC PARTICLES
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes [AD-A161753] N86-22046

ENERGY ABSORPTION
NASA experiments on the B-720 structure and seats N86-21936
NASA seat experiment and occupant responses N86-21939

ENERGY CONSERVATION
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987 [AD-A162792] N86-22443

ENERGY CONVERSION
Excited-state properties of semiconductor electrodes and their application to optical energy conversion [AD-A162774] N86-22432

ENERGY CONVERSION EFFICIENCY
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells [DE86-001620] N86-22000

ENERGY DISSIPATION
Contribution of bending energy losses to the apparent tear energy [AD-A162775] N86-21696
Average loss factors for use in statistical energy analysis N86-21906

ENERGY DISTRIBUTION
Numerical solution of problem on decay of high-temperature region of radiating gas with various initial internal energy distributions N86-22259

ENERGY GAPS (SOLID STATE)
High band GaP 3-5 tunneling junction for silicon multijunction solar cells [NASA-CASE-NPO-16526-1CU] N86-21981
Electronic energy transfer among complex molecules N86-22316
Squeezable tunnel junctions [AD-A161537] N86-22419

ENERGY LEVELS
Operation REDWING, Project 5.2, in-flight participation of a B-52 [AD-A995286] N86-21536
Concepts, problems and opportunities for use of annihilation energy: An annotated briefing on near-term RDT/E to assess feasibility [AD-A161719] N86-22434

ENERGY POLICY
Japan report: Science and technology [JPRS-JST-86-001] N86-21723
Solar energy 85: Resources, technologies, economics --- conferences [ESA-SP-240] N86-21983
Solar radiative energy N86-21984
Role of hydrogen in solar energy utilization: Problems and aspects of the hydrogen issue N86-21993
Solar energy: One decade of research and application, review and outlook N86-21997

ENERGY STORAGE
Photochemical, electrochemical and thermochemical transformation and storage of solar energy: Thermodynamic aspects N86-21991
Utility cycle testing of a 500-kWh zinc chloride battery at the Battery Energy Storage Test (BEST) Facility [DE86-001598] N86-22002

ENERGY TECHNOLOGY
Japan report: Science and technology [JPRS-JST-86-001] N86-21723
The other aspect of solar energy utilization. Solar technologies export enhancement: A central European point of view N86-21985
Passive and hybrid solar systems N86-21986
Solar systems with highly efficient collectors N86-21988
Technology assessment of solar energy utilization N86-21995
Solar energy: One decade of research and application, review and outlook N86-21997

ENERGY TRANSFER
Contribution of bending energy losses to the apparent tear energy [AD-A162775] N86-21696
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport [AD-A162785] N86-21778
YAG:Er3+ cross-relaxation laser N86-22277
Electronic energy transfer among complex molecules N86-22316
Average collisional vibrational energy transfer quantities. The exponential model [AD-A161814] N86-22319
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/) [DE86-001480] N86-22322

ENGINE DESIGN
Jet engine operating and support cost estimating relationship development [AD-A161683] N86-21547

ENGINE PARTS
Thermal mechanical fatigue crack growth. An application for fracture mechanics analyses of gas turbine engine disks [AD-A162634] N86-21962

ENGINE STARTERS
Fuel property effects on the unaided cold starting of a two-cycle diesel engine [AD-A162658] N86-21708

ENGINEERING DRAWINGS
DP format of the drawing files [AD-A162440] N86-22139
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide [AD-A161324] N86-22158

ENTRAINMENT
Experiments on entrainment, mixing and chemical reactions in turbulent jets at large Schmidt number N86-21503

ENVIRONMENT PROTECTION
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil [AD-A162528] N86-22006

ENVIRONMENT SIMULATION
Using spectral estimation techniques in adaptive processing antenna systems [AD-A161670] N86-21732

ENVIRONMENTAL LABORATORIES
Biomedical and environmental sciences at Oak Ridge National Laboratory [DE86-001639] N86-22091

ENVIRONMENTAL MONITORING
Operating research plan. Volume 2: Inventory of research under the National Acid Precipitation Assessment Program [DE86-001593] N86-22007
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center --- research reactor [OEFZS-4324] N86-22008
Inventory of non-federally funded marine pollution research, development and monitoring activities: Great Lakes region [PB86-102308] N86-22012
Pacific Marine Environmental Laboratory [PB86-105525] N86-22078
Five year program strategy for Great Lakes National Program Office, 1986-1990 [PB86-107984] N86-22080
Biomedical and environmental sciences at Oak Ridge National Laboratory [DE86-001639] N86-22091

ENVIRONMENTAL QUALITY
Quality assurance for the acid precipitation measurement program in the US [PB86-107034] N86-22011

ENVIRONMENTAL TESTS
Prototype salvage foaming system [AD-A161499] N86-21688

EPITAXY
Development of a system to produce semiconductor insulator multi-layer structures [AD-A162750] N86-22430

EPOXY COMPOUNDS
Carbon-fiber reinforced epoxy techniques for the X-ray Multimirror Mission (XMM) Low-Energy (LE) telescopes N86-22490

EPOXY MATRIX COMPOSITES
Analysis of aluminum/aramid-epoxy hybrid laminates N86-21595
Behaviour of fibre-reinforced composites under dynamic tension [OUEL-1602/85] N86-21626
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897

EPOXY RESINS
Chemical modification of matrix resin networks with engineering thermoplastics: Morphology and properties of poly(aryl ether sulfone) modified epoxy networks N86-21613
Buckling of laminated composite plates and shell panels [AD-A162723] N86-21623
Aminophenoxycyclotriphosphazene cured epoxy resins and the composites, laminates and structures thereof [NASA-CASE-ARC-11548-1] N86-21686

EQUATIONS OF MOTION
Stochastic non-linear flutter of aeroelastic structures [AD-A162748] N86-21552
Control of missile dispersion via roll rate modulation [AD-A162542] N86-21565
Analysis of the capture of the nominal equilibrium position for the first Brazilian satellite [INPE-3694-PRE/839] N86-21571
Viscous fluid motion in a spinning and nutating cylinder [AD-A162686] N86-21804
Multiple time step partitioned integrators for finite element equations N86-22203

EQUATORIAL ATMOSPHERE
Atmospheric electric fields: A numerical approach [INPE-3704-PRE/844] N86-22025

EQUATORIAL REGIONS
Atmospheric electric fields: A numerical approach [INPE-3704-PRE/844] N86-22025

EQUILIBRIUM
Analysis of the capture of the nominal equilibrium position for the first Brazilian satellite [INPE-3694-PRE/839] N86-21571

EQUILIBRIUM EQUATIONS
Implicit B-differentiability in generalized equations [AD-A160980] N86-22205

EQUIPMENT
Airborne tracking Sun photometer apparatus and system [NASA-CASE-ARC-11622-1] N86-21982
Initial and qualification operational test and evaluation in the acquisition of non-major communication systems [AD-A161729] N86-22439

ERBIUM
YAG:Er3+ cross-relaxation laser N86-22277

ERGODIC PROCESS
Stochastic analysis of drought phenomena [AD-A160947] N86-22060

EROSION
A diffuser heat transfer and erosion code [AD-A162436] N86-21802

ERROR ANALYSIS
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position [AD-A161656] N86-21862
Second order approximations N86-22122

ERROR SIGNALS
Automated weld torch guidance control system [NASA-CASE-MFS-25807-2] N86-21850

ERRORS
Radiation-hard breadboard star tracker. Attachment 1 [AD-A162778] N86-21567
Performance limits of scaled CMOS analog ICs N86-21748

ESTERS
Synthesis of pyromellitic acid esters [NASA-TM-77977] N86-21583

ESTIMATES
Using spectral estimation techniques in adaptive processing antenna systems [AD-A161670] N86-21732
Development of a microprocessor controller for stand-alone photovoltaic power systems [NASA-CR-174723] N86-21979

M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
ESTUARIES
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073
ETCHING
Apparatus for edge etching of semiconductor wafers
[NASA-TM-77998] N86-21720
ETHERS
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether
[NASA-TM-87260] N86-21575
Perfluoro (Imidoylamidine) diamidines
[NASA-CASE-ARC-11402-3] N86-21582
ETHYLENE
Photon energy dependent branching ratios of the inner valence satellites in the photoemission of solid ethylene N86-22336
ETHYLENE OXIDE
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
EUCLIDEAN GEOMETRY
Implicit B-differentiability in generalized equations
[AD-A160980] N86-22205
Shortest paths in Euclidean space with polyhedral obstacles
[AD-A161599] N86-22212
EULER EQUATIONS OF MOTION
Nonlinear acoustic wave propagation in atmosphere
[NASA-CR-176642] N86-22309
EULER-LAGRANGE EQUATION
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
EUROPEAN SPACE AGENCY
Manned spaceflight in the nineties: The European perspective
[NASA-TM-77697] N86-21561
EUROPEAN SPACE PROGRAMS
Norwegian aerospace activities: An overview
[NASA-TM-77711] N86-21562
Space applications of solar energy systems N86-21996
Space research in the Netherlands N86-22456
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461
Capabilities of spectroscopy in the context of X-ray astronomy in the 1900's --- spaceborne astronomy N86-22462
EVALUATION
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
EVAPORATION
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
EVAPORATION RATE
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
EVOLUTION (DEVELOPMENT)
Meteorite craters
[NASA-TM-78013] N86-22507
EXCIMER LASERS
Lasing of XeCl, Xe and KrF excimer moleucles in two-comonent mistures N86-22269
Comparative analysis of optically and electronically pumped broadband excimer lasers N86-22273
EXCIMERS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
H2/F2 chemical laser initiated by excimer flashlamp N86-22276
EXCITATION
Behavior of singlet oxygen in the oxygen-iodine transfer laser
[AD-A161390] N86-21843
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297
Applications of tunable VUV radiation N86-22350
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358
Deexcitation electron spectroscopy of free and coordinated CO N86-22363
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
EXERCISE PHYSIOLOGY
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
EXHAUST EMISSION
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
Burner technology bulletin: Control of NOx emissions from residential gas appliances
[PB86-103892] N86-21873
EXHAUST GASES
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
EXHAUST NOZZLES
Dual material exhaust nozzle flap
[AD-D011998] N86-21548
EXISTENCE THEOREMS
Existence of random variables with values in the dual of a nuclear space
[AD-A161343] N86-22233
EXOBIOLOGY
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 282)
[NASA-SP-7011(282)] N86-22093
EXOSAT SATELLITE
EXOSAT CMA observations of X0512-401 = NGC 1851 --- X ray source N86-22477
EXOSAT observations of the poor cluster of galaxies 2A0335+096 N86-22484
EXPERIMENT DESIGN
Drop tube technical tasks
[NASA-CR-178741] N86-21564
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
EXPERIMENTAL BREEDER REACTOR 2
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
EXPLOITATION
A simulation program with latency exploitation and node tearing
[AD-A161379] N86-21762
EXPLOSIVE FORMING
Controlled powder morphology experiments in megabar 304 stainless steel compaction
[DE86-002416] N86-21672
Tool and process for explosive joining of tubes
[NASA-CASE-LAR-13309-1] N86-21858
EXPLOSIVE WELDING
Tool and process for explosive joining of tubes
[NASA-CASE-LAR-13309-1] N86-21858
EXPLOSIVES
Sensitivity of solid explosives: Minimum energy of a dangerous impact
[NASA-TM-88405] N86-21703
Application of hydrogen analysis to the compatibility testing and long-term aging of explosives
[DE86-001689] N86-21713
Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005
EXPONENTIAL FUNCTIONS
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Isotonic rules for selecting good truncated exponential populations
[AD-A162790] N86-22247
The asymptotic behavior of an exponential-type series
[AD-A162574] N86-22394
EXPOSURE
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
EXTENSIONS
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
EXTERNAL STORES
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
EXTINCTION
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
EXTREME ULTRAVIOLET RADIATION
Extreme ultraviolet emission spectroscopy of atoms and laser applications N86-22313
EXTREMELY HIGH FREQUENCIES
High voltage K sub a -band gyrotron experiment
[AD-A161686] N86-21845
EXTREMUM VALUES
Spectral imaging with a CID camera
[AD-A161608] N86-21824

F

F REGION
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051
FABRICATION
Investigations of the etching chemistry of electronic materials N86-22347
Studies of e(+)e(-) interactions
[DE86-001656] N86-22388
FABRICS
Fatigue properties of multidirectional braided composites
[AD-A162572] N86-21621
FABRY-PEROT INTERFEROMETERS
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[DFVLR-FB-85-56] N86-22399
FACSIMILE COMMUNICATION
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
FACTOR ANALYSIS
Chemical components of the Apollo 15 regolith N86-22518
FACTORIZATION
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor
[DE86-001461] N86-22143
FADING
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading
[AD-A162495] N86-21735
FAILURE
F100 fuel sampling analysis
[AD-A161667] N86-21707
Statistical methodologies appropriate in censored survival analyses and competing risk models
[AD-A162703] N86-22245
FAILURE ANALYSIS
Response and failure analysis of a graphite-epoxy laminate containing terminating internal plies N86-21597
The dynamic response of composite beams to axial impact N86-21603
Life prediction for composite laminates using critical element concepts N86-21608
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
Controlled impact demonstration airframe bending bridges N86-21943
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
FAILURE MODES
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Design of notched plates under compression N86-21594
Viscoelastic behavior and life-time predictions N86-21602
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857

FAR FIELDS
Analysis of a linear antenna two wavelengths long: Consideration of options
[AD-A162799] N86-22222
FAR INFRARED RADIATION
Far infrared diagnostics of electron concentration in combustion MHD plasmas using interferometry and Faraday rotation N86-22401
FAR ULTRAVIOLET RADIATION
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
Activity of the National Synchrotron Light Source (NSLS)
[BNL-51840] N86-22326
Angle resolved photoemission studies of electronic structure N86-22329
Beam line U5: (FEL and diagnostic line) N86-22330
Applications of tunable VUV radiation N86-22350
UV-VUV circular dichroism spectrometer N86-22352
VUV optical properties of cadmium dimethyl N86-22354
Photodissociation of vinyl cyanide N86-22355
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g) N86-22359
FATIGUE (BIOLOGY)
Mechanisms of bioenergetic homeostasis during exercise: A general model
[AD-A161678] N86-22098
FATIGUE (MATERIALS)
Response of thick, notched laminates subjected to tension-compression cyclic loads N86-21610
State-of-the-art review on composite material fatigue/damage tolerance
[FAA/CT-85/7] N86-21615
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
European Science Notes. Volume 39, number 12
[AD-A161069] N86-21721
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
Fatigue crack growth under general-yielding cyclic-loading
[NASA-CR-175049] N86-21951
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952
FATIGUE LIFE
Fatigue properties of multidirectional braided composites
[AD-A162572] N86-21621
Grain boundary oxidation and an analysis of the effects of pre-oxidation on subsequent fatigue life
[NASA-CR-175051] N86-21654
Estimation of the high temperature low cycle fatigue strength of welded joints. 1: Proposal of fundamental estimation methods
[BLL-RISLEY-TR-5236-(9091.9F)] N86-21876
Evalution of low cycle fatigue strength of welded joints at elevated temperature: Applicability of methods of evaluation and plastic restraint
[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877
FATIGUE TESTS
Effect of additional heat treatment of 2024-T3 on the growth of fatigue crack in air and in vacuum
[NASA-TM-77984] N86-21657
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965
FAULT TOLERANCE
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765
Fault diversity in software reliability
[AD-A162757] N86-22182
A hierarchical approach to reliability modeling of fault-tolerant systems
[NASA-CR-176654] N86-22251
FEASIBILITY
Computer-Based Instruction (CBI): Considerations for a user-oriented technology data base
[AD-A161776] N86-22167
FEDERAL BUDGETS
Authorizing appropriations for Landsat commercialization
[HR-REPT-99-177] N86-22448
FEEDBACK
Multi-Input/Multi-Output sensitivity points tuning
[AD-A161641] N86-22193
FEEDBACK CONTROL
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
Quasi-modal vibration control by means of active control bearings
[NASA-TM-87232] N86-21656
Robustness of multivariable feedback systems: Analysis and optimal design
[OUEL-1601/85] N86-22201
FEET (ANATOMY)
Drop foot corrective device
[NASA-CASE-LAR-12259-2] N86-22112
FERMIONS
Some aspects of the phenomenological and microscopic theory of nuclear collective motion N86-22374
FERRITES
Characterization of plasma-sprayed ferrite coatings N86-21854
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415
FERROMAGNETIC FILMS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
FERROUS METALS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
FIBER COMPOSITES
Integrated Composite Analyzer (ICAN): Users and programmers manual
[NASA-TP-2515] N86-21614
A comparison of the bromination dynamics of pitch-based and vapor-grown graphite fibers
[NASA-TM-87275] N86-21683
FIBER OPTICS
Nondestructive evaluation of composites by optical time domain reflectometry N86-21604
All-fiber-optic gyroscope with extended linear dynamic range N86-22389
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[DFVLR-FB-85-56] N86-22399
FIBER ORIENTATION
A comparison of the bromination dynamics of pitch-based and vapor-grown graphite fibers
[NASA-TM-87275] N86-21683
FIBER REINFORCED COMPOSITES
Viscoelastic behavior and life-time predictions N86-21602
Characterization of carbon fibers and fiber-matrix adhesion in composites N86-21612
Thermoplastic matrix composite processing model
[NASA-CR-176639] N86-21619
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Behaviour of fibre-reinforced composites under dynamic tension
[OUEL-1602/85] N86-21626
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692
Improvement of damping in fiber reinforced polymer composites N86-21898
FIBERS
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
FIELD EFFECT TRANSISTORS
Programmable, automated transistor test system
[NASA-TP-2554] N86-21755
FIGHTER AIRCRAFT
F100 fuel sampling analysis
[AD-A161667] N86-21707
FILAMENT WINDING
Development of high order finite elements to model filament wound composites N86-21593
A fracture mechanics analysis of impact damage in a thick composite laminate N86-21607
Fracture of thick graphite/epoxy laminates with part-through surface flaws N86-21611
FILE MAINTENANCE (COMPUTERS)
WXR: Weather wire reformatting package (version 3.00) revised
[PB85-100815] N86-22069
FILLERS
Low loss dielectrics with controllable values of specific permittivity — microwave circuit fillers
[DRIC-T-7632] N86-21752
FILM COOLING
Turbine vane external heat transfer. Volume 1: Analytical and experimental evaluation of surface heat transfer distributions with leading edge showerhead film cooling
[NASA-CR-174827] N86-21546
FINE STRUCTURE
Surface sensitive photoemission EXAFS: A new structural tool N86-22364
FINITE DIFFERENCE THEORY
A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655
Wind driven ocean modeling and ocean model development
[AD-A161742] N86-22074
Numerical methods for differential equations
[AD-A162722] N86-22218
Analysis of a linear antenna two wavelengths long: Consideration of options
[AD-A162799] N86-22222
Investigation of perturbation techniques for nonlinear difference equations and other related problems
[DE86-001162] N86-22224
FINITE ELEMENT METHOD
Development of high order finite elements to model filament wound composites N86-21593
Geometric and material nonlinear bending analysis of laminated composite plates and shells N86-21596
Delamination growth in composite materials
[NASA-CR-178066] N86-21618
Finite-element analysis of adhesively bonded joints
[PB86-100708] N86-21869
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
Finite element design of viscoelastically damped structures N86-21910
On vibration damping analysis using the finite element method N86-21911
Results of finite element analysis of damped structures N86-21912
Vibration isolation of an elevator system N86-21914
Critical damping in complex structures and control systems N86-21927
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
Ground response in alluvial basins due to seismic disturbances
[AD-A162467] N86-22047
Finite element analysis of the Roquefort diagnostic canister
[DE86-000837] N86-22184
Finite element method analysis of nonlinear continua using stochastic equivalent linearization technique N86-22202
Multiple time step partitioned integrators for finite element equations N86-22203
Finite element analysis of two cylindrical expansion problems involving near incompressible material behaviour
[OUEL-1580/85] N86-22227
A large strain finite element formulation for one dimensional membrane elements — soil mechanics
[OUEL-1603/85] N86-22228

FIRE CONTROL
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
FIRE FIGHTING
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525
Emergency Management Computer-Aided Trainer (EMCAT)
[NASA-CR-178738] N86-21554
FIRE PREVENTION
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528
FIREPROOFING
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
FIRES
Aircraft interior panel test criteria derived from full-scale fire tests
[AD-A161637] N86-21529
FIRING (IGNITING)
Spontaneous ignition delay characteristics of hydrocarbon fuel-air mixtures
[NASA-CR-175064] N86-21545
FISSIONABLE MATERIALS
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378
FIXTURES
Test fixture effects in vibration tests of rocket motors
[AD-A161403] N86-21581
FLAME PROPAGATION
Slow combustion of laser plasma and optical charges N86-22290
FLAME SPECTROSCOPY
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635
FLAME TEMPERATURE
Heat release effects in a turbulent, reacting shear layer N86-21788
FLAMMABILITY
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528
FLAPS (CONTROL SURFACES)
Dual material exhaust nozzle flap
[AD-D011998] N86-21548
FLARES
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
FLASH LAMPS
H2/F2 chemical laser initiated by excimer flashlamp N86-22276
FLASH POINT
Fuel property effects on the unaided cold starting of a two-cycle diesel engine
[AD-A162658] N86-21708
FLAT PLATES
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584
FLEXIBILITY
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113
FLEXIBLE BODIES
Simulation of motions of satellites carrying a deployable flexible linkage N86-21568
FLEXIBLE SPACECRAFT
Parameter optimization and attitude stabilization of a flexible spacecraft
[INPE-3680-PRE/830] N86-21572
Flexible structure control in the frequency domain N86-21929
FLEXING
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
FLIGHT CONTROL
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
FLIGHT CREWS
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
FLIGHT INSTRUMENTS
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
FLIGHT PLANS
General aviation pilot and aircraft activity survey
[AD-A161665] N86-21530
FLIGHT RECORDERS
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
CID-720 aircraft high-environment flight instrumentation system N86-21947
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
FLIGHT SIMULATORS
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
FLIGHT TEST INSTRUMENTS
CID-720 aircraft high-environment flight instrumentation system N86-21947
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
FLIGHT TESTS
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories)
[AD-A161664] N86-21537
Relative accuracy of ALPEX aircraft data: An evaluation of the ALPEX intercomparison flight with the NCAR (National Center for Atmospheric Research) Electra, the NOAA (National Oceanic and Atmospheric Administration P3 and the DFVLR (Deutsche Forschungs- und Versuchsanstait fuer Luft-und Raumfahrt) Falcon
[PB86-100823] N86-22067
FLOODS
Preliminary floor, seat, and dummy data N86-21942
FLOW CHARACTERISTICS
Theory of wing rock
[NASA-CR-176640] N86-21520
FLOW CHARTS
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
FLOW COEFFICIENTS
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
FLOW DISTRIBUTION
A new parabolized Navier-Stokes scheme for hypersonic reentry flows N86-21501
Flow field measurements in the 3mx3m low speed wind tunnel of the DFVLR in Goettingen (West Germany)
[DFVLR-MITT-85-14] N86-21558
Self-compensating solenoid valve
[NASA-CASE-ARC-11620-1] N86-21859
EPA (Environmental Protection Agency) oxidant model: Description and evaluation plan
[PB86-103090] N86-22016
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
FLOW EQUATIONS
Wind driven ocean modeling and ocean model development
[AD-A161742] N86-22074
Effect of pulse dependent discharge on relaxing gas flow N86-22265
FLOW MEASUREMENT
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[DFVLR-FB-85-50] N86-21541
Flow field measurements in the 3mx3m low speed wind tunnel of the DFVLR in Goettingen (West Germany)
[DFVLR-MITT-85-14] N86-21558
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
FLOW REGULATORS
Self-compensating solenoid valve
[NASA-CASE-ARC-11620-1] N86-21859
FLOW STABILITY
Investigation of Ferri instability in supersonic inlets
[DFVLR-FB-85-53] N86-21524
Dynamics and stability of flows with moving contact lines N86-21787
Bifurcation and stability of complex flows
[AD-A161405] N86-21799
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
FLOW THEORY
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
FLOW VELOCITY
Current celocity and hydrographic observations of the Straits of Florida: Subtropical Atlantic climate study (STACS) 1983 and 1984
[PB86-108602] N86-22079
FLOW VISUALIZATION
A new method for laminar boundary layer transition visualization in flight: Color changes in liquid crystal coatings
[NASA-TM-87666] N86-21518
Infrared diagnosis using liquid crystal detectors
[NASA-TM-77999] N86-21815
Coherent large-scale structures in high Reynolds number supersonic jets
[NASA-CR-3952] N86-22303
Optical elements formed by compressed gases: Analysis and potential applications
[NASA-TP-2555] N86-22390
FLOWMETERS
Flow field measurements in the 3mx3m low speed wind tunnel of the DFVLR in Goettingen (West Germany)
[DFVLR-MITT-85-14] N86-21558
FLUE GASES
High-temperature ceramic recuperator and combustion air burner programs: Seal development
[PB86-105079] N86-21870
FLUID FILMS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
FLUID FLOW
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521
Bifurcation and stability of complex flows
[AD-A161405] N86-21799
Nonlinear acoustic wave propagation in atmosphere
[NASA-CR-176642] N86-22309
Flow of nuclear matter
[DE86-001484] N86-22384
FLUORESCENCE
Bimane derivatives as fluorescent probes for biological macromolecules
[AD-A162725] N86-22088
Investigation of fluorescence kinetics of dyes by parametric frequency conversion N86-22289
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
U9B: Ultraviolet biophysics N86-22357
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425
FLUORIDES
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
FLUOROHYDROCARBONS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Prototype salvage foaming system
[AD-A161499] N86-21688
FLUTTER
Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
FLUX (RATE)
Energy flow in van der Waals molecules N86-22361
FLY BY WIRE CONTROL
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
FLYBY MISSIONS
Archive of observations of periodic comet Crommelin made during its 1983-84 apparition
[NASA-CR-176650] N86-22508
FOAMS
Prototype salvage foaming system
[AD-A161499] N86-21688
Microcellular foams via phase separation
[DE86-000784] N86-21699
FOCUSING
Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286
Radiation focusing by prism raster N86-22288
FOILS (MATERIALS)
A thin foil high throughput X-ray telescope N86-22489

FOKKER-PLANCK EQUATION
Stochastic non-linear flutter of aeroelastic structures [AD-A162748] N86-21552
FORCE DISTRIBUTION
Friction damping studies at Imperial College N86-21893
FORCED VIBRATION
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
FORECASTING
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting [AD-A161621] N86-22509
FOREST FIRES
Nuclear winter: Smoke generation, deposition, and removal [AD-A161807] N86-22004
FORM FACTORS
Losses in channels with increased internal turbulence [NASA-TM-77995] N86-21515
FORMAT
A synthesis of research on color, typography and graphics as they relate to readability [AD-A161340] N86-21820
WXR: Weather wire reformatting package (version 3.00) revised [PB85-100815] N86-22069
FORMING TECHNIQUES
Fiber reinforced plastics described N86-21725
FORMULAS (MATHEMATICS)
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987 [AD-A162792] N86-22443
FORTRAN
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport [AD-A162785] N86-21778
The LATDYN user's manual [NASA-TM-87635] N86-21953
GETWRD package update: New features and modifications to the GETWRD package [AD-A162698] N86-22179
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design [AD-A162752] N86-22181
FORWARD SCATTERING
Improvements and application of a new type of three component laser Doppler velocimeter [VKI-TM-37] N86-21837
FOURIER SERIES
Vortex conception of rotor and mutual effect of screw/propellers [NASA-TM-77979] N86-21510
FOURIER TRANSFORMATION
Optical acquisition, image and data compression [AD-A161650] N86-22393
Analytical applications of ICP-FTS [DE86-000819] N86-22409
FRACTALS
Fractional calculus to represent complex modulus N86-21885
CWI Newsletter, no. 6, March 1985 [CWI-NEWSLETTER-6] N86-22154
The Pythagoras tree as a Julia set N86-22155
FRACTURE MECHANICS
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Fracture morphology of 2-D carbon-carbon composition N86-21599
Boundary layer effects in nearly incompressible cracked bodies N86-21605
A fracture mechanics analysis of impact damage in a thick composite laminate N86-21607
Fracture of thick graphite/epoxy laminates with part-through surface flaws N86-21611
Variables controlling fatigue crack growth of short cracks [NASA-TM-87208] N86-21661
Contribution of bending energy losses to the apparent tear energy [AD-A162775] N86-21696
Fracture control for fixed offshore structures [AD-A162507] N86-21961
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987 [AD-A162792] N86-22443
FRACTURE STRENGTH
Chemical modification of matrix resin networks with engineering thermoplastics: Morphology and properties of poly(aryl ether sulfone) modified epoxy networks N86-21613
Delamination growth in composite materials [NASA-CR-178066] N86-21618
Analysis and experiments on interlaminar fracture toughness in resin matrix composites [AD-A162689] N86-21622
Transformation toughened ceramics for the heavy duty diesel engine technology program, phase 2 [NASA-CR-175054] N86-22451
FRACTURES (MATERIALS)
Shock fracture and recompaction of ceramics N86-21879
FRACTURING
Void initiation preceding ductile fracture in polycrystalline titanium [AD-A161821] N86-21668
FRAGMENTATION
Fragmentation of small molecules following soft X-ray absorption near the carbon K-edge N86-22333
FRAMES
Spectral imaging with a CID camera [AD-A161608] N86-21824
FREE ELECTRON LASERS
Novel methods for tuning free electron lasers to multiple wavelengths [AD-D011986] N86-21847
Future possibilities of free-electron laser N86-22262
Influence of electromagnetic wave and wiggler fields inhomogeneity on a free-electron laser N86-22264
Undulator based beamline studies on U5 N86-22331
FREE ELECTRONS
Earthquake light [AD-A161385] N86-22042
Beam line U5: (FEL and diagnostic line) N86-22330
FREE ENERGY
A finite element analysis of a class of problems in elasto-plasticity with hidden variables [AD-A161642] N86-21957
FREE RADICALS
Synthesis of hydrophobic, crosslinkable resins [AD-A162702] N86-21692
FREQUENCIES
Average loss factors for use in statistical energy analysis N86-21906
FREQUENCY CONVERTERS
Investigation of fluorescence kinetics of dyes by parametric frequency conversion N86-22289
FREQUENCY DISTRIBUTION
Flexible structure control in the frequency domain N86-21929
FREQUENCY HOPPING
Spread spectrum acquisition and tracking [AD-A162442] N86-21734
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading [AD-A162495] N86-21735
FREQUENCY RANGES
Use of skin damping treatments to control airframe dynamic response for interior noise control N86-21919
Passive and Active Control Of Space Structures (PACOSS) N86-21931
FREQUENCY SHIFT
Improvements and application of a new type of three component laser Doppler velocimeter [VKI-TM-37] N86-21837
FRESH WATER
Freshwater wetlands for wastewater management environmental assessment handbook [PB86-106564] N86-21975
FRICTION
Runway rubber removal specification development [DOT/FAA/PN-85/33] N86-21556
An experimental study of convective heat transfer, friction, and rheology for non-Newtonian fluids: Polymer solutions, suspensions of fibers, and suspensions of particulates N86-21786
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
Friction damping studies at Imperial College N86-21893
Structural damping of shuttle orbiter and ascent vehicles N86-21904
New proposed dynamic vibration absorbers for excited structures N86-21908
FRICTION DRAG
Damping properties of steam turbine blades N86-21890
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
FUEL COMBUSTION
Combustion engine for solid and liquid fuels [NASA-TM-77714] N86-21855
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel [AD-A161652] N86-21861
FUEL CONSUMPTION
General aviation pilot and aircraft activity survey [AD-A161665] N86-21530
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel [AD-A161652] N86-21861
FUEL CONTROL
Fluid slosh studies for spinning spacecraft [ONERA-RT-8/3269-SY] N86-21807
FUEL CORROSION
Corrosion and corrosion prevention in gas turbines [NASA-TM-77924] N86-21544
FUEL PUMPS
F100 fuel sampling analysis [AD-A161667] N86-21707
FUEL SYSTEMS
F100 fuel sampling analysis [AD-A161667] N86-21707
FUELS
F100 fuel sampling analysis [AD-A161667] N86-21707
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques [AD-A162746] N86-21710
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel [AD-A161652] N86-21861
FULL SCALE TESTS
Aircraft interior panel test criteria derived from full-scale fire tests [AD-A161637] N86-21529
FUNCTIONS (MATHEMATICS)
Recent progress on the numerical verification of the Riemann hypothesis N86-22120
Mathematical libraries in Ada N86-22156
Implicit B-differentiability in generalized equations [AD-A160980] N86-22205
A study of singularities in boundary-fitted coordinate systems [AD-A161756] N86-22214
FURNACES
Role of molybdenum in the Na sub 2SO sub 4 induced corrosion of superalloys at high temperatures [NASA-TM-87235] N86-21658
Burner technology bulletin: Control of NOx emissions from residential gas appliances [PB86-103892] N86-21873
FUSELAGES
Laminated damped fuselage structures N86-21916
Integrated damped fuselage structure N86-21918
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949

G

GADOLINIUM
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
GALACTIC CLUSTERS
High resolution X-ray spectroscopy of clusters of galaxies — spaceborne astronomy N86-22465
EXOSAT observations of the poor cluster of galaxies 2A0335+096 N86-22484
GALACTIC COSMIC RAYS
The X-ray background — galactic radiation N86-22463
GALACTIC NUCLEI
The X-ray spectroscopy of active galactic nuclei N86-22464
A relativistic rotating massive object with saturation of magnetic monopoles — galactic nuclei, quasars N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object — galactic nuclei, quasars N86-22479
Dispersive X-ray spectroscopy with transmission gratings — X ray astronomy N86-22492
GALACTIC RADIATION
The X-ray properties of normal galaxies. What do we know and what can we learn with the next generation of X-ray telescopes? — spaceborne telescope N86-22466
GALERKIN METHOD
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
GALLIUM ARSENIDES
Gallium Arsenide structures and interfaces formed by molecular beam epitaxy N86-21747
Optically controlled phased array antenna concepts using GaAs monolithic microwave integrated circuits [NASA-TM-87229] N86-21757

Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport
[AD-A162785] N86-21778
Oxidation of GaSs(110) cleaved surface N86-22345
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432

GAMMA RAY SPECTRA
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415

GAMMA RAYS
Monte Carlo calculations on the direct cable drive due to gamma radiation
[AD-A161734] N86-22375

GAS ANALYSIS
Application of hydrogen analysis to the compatibility testing and long-term aging of explosives
[DE86-001689] N86-21713

GAS CHROMATOGRAPHY
Multidimensional high-resolution gas chromatographic investigations of hydrocarbon fuels and various turbine engine fuel precursors
[AD-A162660] N86-21709

GAS DETECTORS
Semiconductor laser source for natural gas leak detection
[PB86-102811] N86-21849

GAS DISCHARGE TUBES
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g)
N86-22359

GAS DISCHARGES
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

GAS DISSOCIATION
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction
[NASA-TM-78001] N86-21791

GAS DYNAMICS
The influence of initial and boundary conditions on gaseous detonation waves
[AD-A162631] N86-21803
Damping properties of steam turbine blades
N86-21890
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
Numerical solution of problem on decay of high-temperature region of radiating gas with various initial internal energy distributions N86-22259
Effect of pulse dependent discharge on relaxing gas flow N86-22265
Optical elements formed by compressed gases: Analysis and potential applications
[NASA-TP-2555] N86-22390

GAS EXPANSION
The influence of initial and boundary conditions on gaseous detonation waves
[AD-A162631] N86-21803

GAS FLOW
On the boundary treatment in spectral methods for hyperbolic systems
[NASA-CR-178055] N86-22204
Effect of pulse dependent discharge on relaxing gas flow N86-22265

GAS HEATING
Burner technology bulletin: Control of NOx emissions from residential gas appliances
[PB86-103892] N86-21873

GAS IONIZATION
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261
Measurements of magnetoacoustic waves in MHD plasmas N86-22400

GAS LASERS
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261

GAS MIXTURES
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772

GAS TURBINE ENGINES
Technology for Bayton-cycle powerplants using solar and nuclear energy
[NASA-TP-2558] N86-21577

GAS TURBINES
Corrosion and corrosion prevention in gas turbines
[NASA-TM-77924] N86-21544
Thermal mechanical fatigue crack growth. An application for fracture mechanics analyses of gas turbine engine disks
[AD-A162634] N86-21962

GAS-ION INTERACTIONS
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide
[AD-A162694] N86-21645

GAS-METAL INTERACTIONS
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655

GASEOUS DIFFUSION
Numerical solution of problem on decay of high-temperature region of radiating gas with various initial internal energy distributions N86-22259

GASES
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380

GASTROINTESTINAL SYSTEM
Vection-induced gastric dysrhythmias and motion sickness
[NASA-CR-176620] N86-22095

GENERAL AVIATION AIRCRAFT
Effects of wing modification on an aircraft's aerodynamic parameters as determined from flight data
[NASA-TM-87591] N86-21550

GEOCHEMISTRY
Geothermal potential of Adak Island, Alaska
[AD-A161824] N86-21998
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519
The Apennine Bench Formation revisited N86-22526

GEOGRAPHIC INFORMATION SYSTEMS
Representation of urban districts in a geographical information system
[PB86-109451] N86-22455

GEOGRAPHY
Comparison of manually produced and automated cross country movement maps using digital image processing techniques
[NASA-CR-176653] N86-21969
The effects of color-coding in geosit displays. 1: Color as a redundant code
[AD-A161107] N86-22108
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
Geonames processing system functional design specification. Volume 3: Advanced type placement
[AD-A162552] N86-22175

GEOLOGY
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data
[NASA-CR-176660] N86-21970
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Apollo 15 regolith breccias and soils: Comparative petrology and chemistry N86-22524
The materials and formation of the imbrium basin
N86-22525
Some observations on the geology of the Apollo 15 landing site N86-22527
Geologic setting of the Apollo 15 landing site
N86-22529

GEOMAGNETISM
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023
X-ray microbursts and VLF chorus
[AD-A162531] N86-22049
A meridional circulation model to study upper atmosphere seasonal phenomena
[INPE-2716-PRE/852] N86-22058
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

GEOMETRY
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Core level shifts and electronic structure of Cu3Au
N86-22334

GEOMORPHOLOGY
Desert studies: A global view
[AD-A161453] N86-21971

GEOPHYSICS
Geothermal potential of Adak Island, Alaska
[AD-A161824] N86-21998
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077

GEOPOTENTIAL
Geothermal potential of Adak Island, Alaska
[AD-A161824] N86-21998

GEOPOTENTIAL HEIGHT
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048

GEOSYNCHRONOUS ORBITS
TV-SAT final orbit acquisition optimization strategy
[INPE-3679-PRE/829] N86-21570

GEOTHERMAL ANOMALIES
Constraints on lithospheric structure from satellite potential field data: Africa and Asia. Analysis and interpretation of MAGSAT anomalies over North Africa
[NASA-CR-176611] N86-21968

GEOTHERMAL RESOURCES
Geothermal potential of Adak Island, Alaska
[AD-A161824] N86-21998
Coso: Example of a complex geothermal reservoir
[AD-A162575] N86-21999

GERMANIUM
Metal-insulator transition on the Ge(001) surface
N86-22327

GLASS
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Contribution to the photometric determination of small amounts of boron trioxide in glasses
[NASA-TM-77955] N86-21677
Electron microscopic determination of the metastable dissociation region in the system Li sub 2SiO3-SiO sub 2
[NASA-TM-77980] N86-21681
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
Quantitative methods for the chemical analysis of sealing glasses
[DE86-001662] N86-21702
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254

GLASS FIBER REINFORCED PLASTICS
Behaviour of fibre-reinforced composites under dynamic tension
[OUEL-1602/85] N86-21626
Fiber reinforced plastics described N86-21725

GLASS FIBERS
Quasi-containerless glass formation method and apparatus
[NASA-CASE-MFS-28090-1] N86-21684
Containerless high purity pulling process and apparatus for glass fiber
[NASA-CASE-MFS-25905-2] N86-21718
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396

GLASS LASERS
Slow combustion of laser plasma and optical charges
N86-22290

GLIDING
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086

GLOBAL AIR POLLUTION
CZCS (Coastal Zone Color Scanner) atlas of water optical properties in the alboran sea
[AD-A162503] N86-22075

GLOBULAR CLUSTERS
EXOSAT CMA observations of X0512-401 = NGC 1851 --- X ray source N86-22477

GLOW DISCHARGES
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772

GOLD ALLOYS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
GOVERNMENT PROCUREMENT
An analysis of foreign source dependence for critical microcircuits of USAF avionics components
[AD-A161311] N86-22436
GRADIENTS
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems
[AD-A161550] N86-21730
GRAIN BOUNDARIES
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
Grain boundary oxidation and an analysis of the effects of pre-oxidation on subsequent fatigue life
[NASA-CR-175051] N86-21654
Effect of boron on tensile properties of B2 BeAl
[NASA-CR-175074] N86-21656
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Morphological stability of continuous intergranular phases
[DE86-001483] N86-21701
Unclassified publications of Lincoln Laboratory, volume 10
[AD-A161752] N86-22446
GRAIN SIZE
The effects of surface finish and grain size on the strength of sintered silicon carbide
[NASA-TM-77871] N86-21616
GRANULAR MATERIALS
Experimental study of shear flows and convective heat transfer characteristics of granular materials N86-21785
GRAPHIC ARTS
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
GRAPHITE
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air N86-21632
A comparison of the bromination dynamics of pitch-based and vapor-grown graphite fibers
[NASA-TM-87275] N86-21683
GRAPHITE-EPOXY COMPOSITES
Response and failure analysis of a graphite-epoxy laminate containing terminating internal plies N86-21597
Nondestructive evaluation of composites by optical time domain reflectometry N86-21604
A fracture mechanics analysis of impact damage in a thick composite laminate N86-21607
Response of thick, notched laminates subjected to tension-compression cyclic loads N86-21610
Fracture of thick graphite/epoxy laminates with part-through surface flaws N86-21611
Delamination growth in composite materials
[NASA-CR-178066] N86-21618
Fatigue properties of multidirectional braided composites
[AD-A162572] N86-21621
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897
GRAPHITIZATION
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
GRAPHS (CHARTS)
Plane representations of graphs and visibility between parallel segments
[AD-A161689] N86-21770
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
GRATINGS (SPECTRA)
Diffraction efficiency of holographic gratings with symmetrical profiles N86-22283
Dispersive X-ray spectroscopy with transmission gratings --- X ray astronomy N86-22492
The application of reflection gratings to a large area X-ray spectroscopy mission: A discussion of scientific requirements and various design options --- spaceborne astronomy N86-22498
GRAVITY GRADIENT SATELLITES
Analysis of the capture of the nominal equilibrium position for the first Brazilian satellite
[INPE-3694-PRE/839] N86-21571
GRAVITY WAVES
Scintillation Detecting and Ranging (scidar/lidar) description of a gravity wave and associated turbulence N86-22034
GRAZING INCIDENCE
Multispectral glancing incidence X-ray telescope
[NASA-CASE-MFS-28013-1] N86-22459
Electroform replication of grazing incidence X-ray optics --- spaceborne telescopes N86-22491
The application of reflection gratings to a large area X-ray spectroscopy mission: A discussion of scientific requirements and various design options --- spaceborne astronomy N86-22498
GREAT LAKES (NORTH AMERICA)
Inventory of non-federally funded marine pollution research, development and monitoring activities: Great Lakes region
[PB86-102308] N86-22012
Five year program strategy for Great Lakes National Program Office, 1986-1990
[PB86-107984] N86-22080
GROUND EFFECT MACHINES
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
GROUND WATER
Research projects of the Water Resources Research Institute during FY 1983
[PB86-101235] N86-21973
Colorado Water Resources Research Institute activities report, FY 1981-1984
[PB86-101367] N86-21974
GROWTH
Complexity of the generalized mover's problem
[AD-A161378] N86-22209
GUIDANCE SENSORS
Earth sensor for artificial satellite control discussed N86-21724
GULF STREAM
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
GUNN DIODES
Optically triggered bulk device gunn oscillator
[AD-D011977] N86-21780

H

HADRONS
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381
HALIDES
A study of the mechanism of population of high lying rotational states in hydrogen halides
[AD-A161460] N86-21588
HALL EFFECT
The effect of contacts on the counting characteristics of heavily doped n-type cadmium telluride N86-21746
HALLEY'S COMET
Archive of observations of periodic comet Crommelin made during its 1983-84 apparition
[NASA-CR-176650] N86-22508
HANDBOOKS
Handbook for SRM (Standard Reference Materials) users
[PB86-110897] N86-21649
Freshwater wetlands for wastewater management environmental assessment handbook
[PB86-106564] N86-21975
An organizational development handbook
[AD-A161414] N86-22438
HARDENING (MATERIALS)
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
HARMONIC CONTROL
An experimental study of passive damping and active control of large space structures N86-21925
HARMONIC FUNCTIONS
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886
HARMONIC GENERATIONS
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
HARMONIC GENERATORS
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
HARNESSES
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
HAZARDS
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
HEALTH
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
HEALTH PHYSICS
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
HEARING
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
HEART
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
HEART DISEASES
Advanced clinical research in shock and trauma
[AD-A162730] N86-22103
HEART RATE
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
HEAT ACCLIMATIZATION
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
HEAT FLUX
Measurement of heat-transfer coefficients in shock wave-turbulent boundary layer interaction regions with a multi-layered thin film heat transfer gauge
[NASA-TM-77958] N86-21790
Current celocity and hydrographic observations of the Straits of Florida: Subtropical Atlantic climate study (STACS) 1983 and 1984
[PB86-108602] N86-22079
HEAT GENERATION
Process heat applications --- solar heating N86-21990
HEAT MEASUREMENT
The development of a heat transfer measurement technique for application to rotating turbine blades
[OUEL-1584/85] N86-21810
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
HEAT PIPES
Transient heat pipe investigations for space power systems
[DE86-000813] N86-21806
HEAT PUMPS
Volumetric trochoidal gas compressor for use as a heat pump
[PB86-102720] N86-21871
Free-piston Stirling engine development
[PB86-102746] N86-21872
HEAT RESISTANT ALLOYS
Development of an elevated temperature aluminum alloy containing Al3X-type dispersed phases N86-21650
Grain boundary oxidation and an analysis of the effects of pre-oxidation on subsequent fatigue life
[NASA-CR-175051] N86-21654
Role of molybdenum in the Na sub 2SO sub 4 induced corrosion of superalloys at high temperatures
[NASA-TM-87235] N86-21658
Evaluation of a standard test method for total hemispherical emittance of surfaces from 293K to 1673K
[NASA-TM-87681] N86-21660
Improvements in the weldability of a superconductor sheath material
[DE86-000748] N86-21867
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952
HEAT SHIELDING
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949

HEAT STORAGE
District heating by solar energy with heat storage N86-21989
HEAT TOLERANCE
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
HEAT TRANSFER
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction
[NASA-TM-78001] N86-21791
A diffuser heat transfer and erosion code
[AD-A162436] N86-21802
The development of a heat transfer measurement technique for application to rotating turbine blades
[OUEL-1584/85] N86-21810
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
HEAT TRANSFER COEFFICIENTS
Turbine vane external heat transfer. Volume 1: Analytical and experimental evaluation of surface heat transfer distributions with leading edge showerhead film cooling
[NASA-CR-174827] N86-21546
Measurement of heat-transfer coefficients in shock wave-turbulent boundary layer interaction regions with a multi-layered thin film heat transfer gauge
[NASA-TM-77958] N86-21790
Effect of a rotor wake on the local heat transfer on the forward half of a circular cylinder
[NASA-TM-87234] N86-21794
HEAT TRANSMISSION
Heat release effects in a turbulent, reacting shear layer N86-21788
HEAT TREATMENT
A new NDE method for coated carbon-carbon composites
[AD-D011978] N86-21625
Effect of additional heat treatment of 2024-T3 on the growth of fatigue crack in air and in vacuum
[NASA-TM-77984] N86-21657
Evaluation of a standard test method for total hemispherical emittance of surfaces from 293K to 1673K
[NASA-TM-87681] N86-21660
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670
HEATING
Geothermal potential of Adak Island, Alaska
[AD-A161824] N86-21998
HEAVY IONS
Flow of nuclear matter
[DE86-001484] N86-22384
HEIGHT
Investigations on statistics of terrain height
[AD-A162517] N86-22243
HELICOPTER CONTROL
Limiting performance of nonlinear systems with applications to helicopter vibration control
[AD-A161457] N86-21551
A contribution to the digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[DFVLR-FB-85-55] N86-21553
HELICOPTER PERFORMANCE
Helicopter performance computer programs for HP-41 hand-held computer
[AD-A162794] N86-21539
HELICOPTER WAKES
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521
HELICOPTERS
The role of vibration and rattle in human response to helicopter noise
[AD-A162486] N86-22110
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
HELIUM
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
HELIUM-NEON LASERS
Development of shearographic imaging system
[AD-A161819] N86-21826
HERBIG-HARO OBJECTS
Plasma processes in the excitation of Herbig-Haro objects
[TRITA-EPP-84-09] N86-22413
HETEROCYCLIC COMPOUNDS
An experimental evaluation of the effects of selected organic compounds on the formation of insolubles in diesel fuels
[AD-A161323] N86-21586
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
HETEROJUNCTION DEVICES
Single-frequency CW lasing in injection laser based on terraced heterostructure with external dispersion cavity N86-22274
HEURISTIC METHODS
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
Planning by search through simulations
[AD-A162470] N86-21864
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169
Two new approximate solution techniques for a moving target problem when searcher motion is constrained
[AD-A162491] N86-22171
HF LASERS
H2/F2 chemical laser initiated by excimer flashlamp N86-22276
HIERARCHIES
Hierarchical composition of VLSI circuits N86-22148
A hierarchical approach to reliability modeling of fault-tolerant systems
[NASA-CR-176654] N86-22251
HIGH ALTITUDE
Kinetics and spectroscopy of high altitude infrared emissions
[PSI-G050-SR-207] N86-22032
HIGH ASPECT RATIO
Results of finite element analysis of damped structures N86-21912
HIGH ENERGY ELECTRONS
The measuring assembly for a primary standard absorbed dose calorimeter — high energy particle beams
[NPL-RS(EXT)-74] N86-21814
HIGH ENERGY INTERACTIONS
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381
HIGH FLUX ISOTOPE REACTORS
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378
HIGH FREQUENCIES
High frequency-heated air turbojet
[NASA-TM-77710] N86-21543
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051
HIGH POWER LASERS
Laser propagation code study
[AD-A161370] N86-21842
New findings on creation of powerful tunable subpicosecond solid-state lasers N86-22263
HIGH PRESSURE
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
HIGH RESOLUTION
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
High resolution acoustic microscopy N86-22301
High resolution photoemission investigation: The oxidation of W N86-22348
HIGH SPEED
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827
Apparatus for transmitting data from high speed rotors
[AD-D011991] N86-21831
HIGH SPEED CAMERAS
Controlled impact demonstration on-board (interior) photographic system N86-21946
HIGH SPEED PHOTOGRAPHY
Controlled impact demonstration on-board (interior) photographic system N86-21946
HIGH STRENGTH
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
HIGH STRENGTH ALLOYS
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662
HIGH TEMPERATURE
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
High-temperature ceramic recuperator and combustion air burner programs: Seal development
[PB86-105079] N86-21870
Estimation of the high temperature low cycle fatigue strength of welded joints. 1: Proposal of fundamental estimation methods
[BLL-RISLEY-TR-5236-(9091.9F)] N86-21876
Evalution of low cycle fatigue strength of welded joints at elevated temperature: Applicability of methods of evaluation and plastic restraint
[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877
HIGH TEMPERATURE AIR
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air N86-21632
HIGH TEMPERATURE PLASMAS
Slow combustion of laser plasma and optical charges N86-22290
HIGH TEMPERATURE TESTS
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
HOLOGRAPHY
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques
[AD-A162746] N86-21710
Diffraction efficiency of holographic gratings with symmetrical profiles N86-22283
X-ray holography experiments on the U15 beam line N86-22371
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
HOMEOSTASIS
Mechanisms of bioenergetic homeostasis during exercise: A general model
[AD-A161678] N86-22098
HOMOGENEITY
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
HONEYCOMB CORES
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
HOOKS
Claw grip contact probe for flat packs
[AD-D011997] N86-21782
HORIZONTAL FLIGHT
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
HORIZONTAL ORIENTATION
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052
HOT CORROSION
Corrosion and corrosion prevention in gas turbines
[NASA-TM-77924] N86-21544
Role of molybdenum in the Na sub 2SO sub 4 induced corrosion of superalloys at high temperatures
[NASA-TM-87235] N86-21658
HOT ELECTRONS
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
HOT PRESSING
Manufacture of high-density ceramic sinters
[NASA-TM-77925] N86-21678
Amphibole ceramics: Conceptual development and preliminary experiments
[DE86-001445] N86-21700
Removal of glass adhered to sintered ceramics in hot isostatic pressing
[NASA-TM-77930] N86-21719
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide
[AD-A161455] N86-21955
HOVERING
Helicopter performance computer programs for HP-41 hand-held computer
[AD-A162794] N86-21539
HUBBLE SPACE TELESCOPE
Graphical techniques to assist in pointing and control studies of orbiting spacecraft
[NASA-TP-2575] N86-21559
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928

Surface analysis of space telescope material specimens
[NASA-CR-178712] N86-22460
HUMAN BEHAVIOR
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525
HUMAN BEINGS
Coincidental chemical signature identifier
[AD-A161269] N86-21637
Specification and preliminary validation of IAT (Integrated Analysis Techniques) methods: Executive summary
[AD-A162509] N86-21736
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
HUMAN PERFORMANCE
Fracture control for fixed offshore structures
[AD-A162507] N86-21961
Visual perception in correlated noise N86-22106
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
HUMAN REACTIONS
The role of vibration and rattle in human response to helicopter noise
[AD-A162486] N86-22110
HUMIDITY
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
The aging correlation (RH + t): Relative humidity (%) + temperature (deg C)
[NASA-CR-176661] N86-21980
HYDRAULIC CONTROL
A contribution to the digital compensation of periodic disturbances with frequencies in bounded intervals --- in helicopters
[DFVLR-FB-85-55] N86-21553
HYDRAULIC EQUIPMENT
Personnel emergency carrier vehicle
[NASA-CASE-KSC-11282-1] N86-22452
HYDRAULIC FLUIDS
Toxic hazards research unit annual technical report: 1985
[AD-A161558] N86-22097
HYDRAULIC TEST TUNNELS
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519
HYDRAZINES
Toxic hazards research unit annual technical report: 1985
[AD-A161558] N86-22097
HYDROCARBON FUELS
Multidimensional high-resolution gas chromatographic investigations of hydrocarbon fuels and various turbine engine fuel precursors
[AD-A162660] N86-21709
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
HYDROCARBONS
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
HYDRODYNAMICS
Piezoviscous effects in nonconformal contacts lubricated hydrodynamically
[NASA-TM-87141] N86-21797
Viscous fluid motion in a spinning and nutating cylinder
[AD-A162686] N86-21804
HYDROELASTICITY
New proposed dynamic vibration absorbers for excited structures N86-21908
HYDROGEN
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Studies of the Ta(110) surface and hydrogen on Ta(110) N86-22342
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430
HYDROGEN CHLORIDES
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
HYDROGEN COMPOUNDS
A study of the mechanism of population of high lying rotational states in hydrogen halides
[AD-A161460] N86-21588
HYDROGEN EMBRITTLEMENT
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960
HYDROGEN PLASMA
Electrically excited phenomena in gas-phase devices
[AD-A161527] N86-21764
HYDROGEN PRODUCTION
Critical view of photochemical and photoelectrochemical methods for hydrogen production --- solar energy N86-21992
Role of hydrogen in solar energy utilization: Problems and aspects of the hydrogen issue N86-21993
HYDROGEOLOGY
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077
HYDROGRAPHY
Current celocity and hydrographic observations of the Straits of Florida: Subtropical Atlantic climate study (STACS) 1983 and 1984
[PB86-108602] N86-22079
HYDROLOGY
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024
WXR: Weather wire reformatting package (version 3.00) revised
[PB85-100815] N86-22069
HYDROXIDES
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643
HYDROXYL EMISSION
The nightglow hydroxl (8-3) band emission: A comparison of experiment and theory N86-22031
HYPERSONIC FLOW
A new parabolized Navier-Stokes scheme for hypersonic reentry flows N86-21501
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258
HYPOTHERMIA
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100
HYSTERESIS
Damping properties of steam turbine blades N86-21890
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21894
Hysteresis effects in Ar+ laser with nonlinear absorber in the cavity N86-22268

I

IBM COMPUTERS
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
ICE
Air mass modification in the marginal ice zone
[AD-A161745] N86-22062
ICE FORMATION
The icing research aircraft DO28, D-IFMP of DFVLR, and its measuring equipment
[DFVLR-MITT-85-12] N86-22064
IDENTIFYING
Coincidental chemical signature identifier
[AD-A161269] N86-21637
IGNITION
Spontaneous ignition delay characteristics of hydrocarbon fuel-air mixtures
[NASA-CR-175064] N86-21545
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
ILLUMINANCE
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255
IMAGE FILTERS
Spectral imaging with a CID camera
[AD-A161608] N86-21824
IMAGE MOTION COMPENSATION
Spectral imaging with a CID camera
[AD-A161608] N86-21824
IMAGE PROCESSING
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Comparison of manually produced and automated cross country movement maps using digital image processing techniques
[NASA-CR-176653] N86-21969
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region
[DFVLR-FB-85-49] N86-21972
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015
Visual perception in correlated noise N86-22106
Color image processing with computer-generated spatial filters in a dispersed white-light optical system N86-22125
Architectural elements for bitmap graphics N86-22127
Advanced mail systems technology. Executive summary and appendices A-G
[AD-A161003] N86-22131
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Optical acquisition, image and data compression
[AD-A161650] N86-22393
Edge detection
[AD-A162662] N86-22395
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431
IMAGE RESOLUTION
Contact X-ray microscopy of biological materials N86-22370
Optical acquisition, image and data compression
[AD-A161650] N86-22393
IMAGERY
Universal wavefront sensor apparatus
[AD-D011983] N86-21830
IMAGING TECHNIQUES
An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728
Determination of the modulation transfer function of line scanned infrared imaging systems
[AD-A161521] N86-21822
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Development of shearographic imaging system
[AD-A161819] N86-21826
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827
The XMM imaging Bragg spectrometer with a doubly curved crystal N86-22493
A multiwire proportional counter for low energy X-ray imaging --- X ray astronomy N86-22499
A multiplex coding imaging spectrometer for X-ray astronomy N86-22501
The Penning gas imager in a space application --- X ray astronomy N86-22503
X-ray imaging spectroscopy with CCDs --- X ray astronomy N86-22505
IMIDES
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11538-1SB] N86-21590
IMMUNITY
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
IMMUNOLOGY
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants
[AD-A162444] N86-22085
IMPACT DAMAGE
Preliminary floor, seat, and dummy data N86-21942
Controlled impact demonstration airframe bending bridges N86-21943

IMPACT LOADS
CID overview N86-21934
CID flight/impact N86-21935
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
IMPACT STRENGTH
Experimental measurement of material damping for space structures N86-21887
IMPACT TESTS
Full-Scale Transport controlled Impact Demonstration [NASA-CP-2395] N86-21933
NASA seat experiment and occupant responses N86-21939
Structural loads preliminary results N86-21940
Preliminary floor, seat, and dummy data N86-21942
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
Controlled impact demonstration on-board (interior) photographic system N86-21946
CID-720 aircraft high-environment flight instrumentation system N86-21947
Impact dynamics instrumentation N86-21948
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
IMPEDANCE
Ionospheric effects to antenna impedance [NASA-TM-77956] N86-21727
IMPREGNATING
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
IMPROVEMENT
Improvements and application of a new type of three component laser Doppler velocimeter [VKI-TM-37] N86-21837
Improvements in the weldability of a superconductor sheath material [DE86-000748] N86-21867
IMPULSE GENERATORS
Composite material damping using impulse technique N86-21895
IMPULSES
Space-frequency sampling criteria for electromagnetic scattering of a finite object [AD-A162553] N86-21737
IMPURITIES
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities [NAL-TR-866T] N86-22314
INCLUSIONS
A study on inclusion formation mechanism in alpha-LiIO sub 3 crystals [NASA-TM-77943] N86-22417
INCOMPRESSIBLE BOUNDARY LAYER
The evolution of a wave train in a three-dimensional boundary layer [FFA-TN-1985-54] N86-21809
INCONEL (TRADEMARK)
Overload effects in sustained load crack growth in Inconel 718 [AD-A162739] N86-21965
INDEPENDENT VARIABLES
The electroplating of laminated chromium [AD-A162751] N86-21671
Statistical methodologies appropriate in censored survival analyses and competing risk models [AD-A162703] N86-22245
INDEXES (DOCUMENTATION)
Scientific and technical information output of the Langley Research Center for Calendar Year 1985 [NASA-TM-87655] N86-22445
INDIA
Periodicities in the All India Rainfall series and in the drought and flood area indices [INPE-3717-PRE/853] N86-22057
INDIUM
Modulation of IR lasers by semiconducting plasma N86-22256
INDUSTRIAL PLANTS
LAMPF: Its origins, history, and accomplishments [DE86-000814] N86-22383
INELASTIC SCATTERING
Inelastic scattering in condensed matter with high intensity Moessbauer radiation [DE86-002461] N86-22321
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/) [DE86-001480] N86-22322
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane [AD-A162548] N86-22426
INERTIA
Some aspects of the phenomenological and microscopic theory of nuclear collective motion N86-22374
INERTIAL UPPER STAGE
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921
INFERENCE
Stationary time series, quantile functions, nonparametric inference and rank transform spectrum [AD-A161749] N86-22238
Bootstrapping Cox's regression model [AD-A162443] N86-22241
On Mini Conference on Order Restricted Inference held at Iowa University Campus on 11-13 September 1985 [AD-A162478] N86-22242
INFORMATION DISSEMINATION
Area-time lower-bound techniques with application to sorting [AD-A161327] N86-21758
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design [AD-A162752] N86-22181
INFORMATION FLOW
Area-time lower-bound techniques with application to sorting [AD-A161327] N86-21758
The area-time complexity of sorting [AD-A161562] N86-21767
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design [AD-A162752] N86-22181
INFORMATION RETRIEVAL
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region [DFVLR-FB-85-49] N86-21972
Dictionary machines for cube-class networks [AD-A161393] N86-22136
GETWRD package update: New features and modifications to the GETWRD package [AD-A162698] N86-22179
INFORMATION SYSTEMS
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories) [AD-A161664] N86-21537
The Army Research Institute Unit Performance Research and Development Center [NASA-CR-176618] N86-21706
European Science Notes. Volume 39, number 12 [AD-A161069] N86-21721
Area-time lower-bound techniques with application to sorting [AD-A161327] N86-21758
Decision support system for ASD (Aeronatical Systems Division) program managers [AD-A161690] N86-22137
INFRARED DETECTORS
Infrared diagnosis using liquid crystal detectors [NASA-TM-77999] N86-21815
Determination of the modulation transfer function of line scanned infrared imaging systems [AD-A161521] N86-21822
Infrared sensor target [AD-D011996] N86-22398
INFRARED IMAGERY
Determination of the modulation transfer function of line scanned infrared imaging systems [AD-A161521] N86-21822
INFRARED LASERS
Modulation of IR lasers by semiconducting plasma N86-22256
INFRARED RADIATION
Observations of airglow O2 (1 sigma) atmospheric band at 8645A and the rotational temperature at 23 S N86-22030
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes [AD-A161753] N86-22046
Spectroscopic, kinetic, and dynamic experiments on atmospheric species [AD-A162691] N86-22050
Measurement of atmospheric transmission over long paths in the infrared spectral region [AD-A161258] N86-22392
INFRARED SIGNATURES
Universal wavefront sensor apparatus [AD-D011983] N86-21830
Infrared sensor target [AD-D011996] N86-22398
INFRARED SPECTRA
Kinetics and spectroscopy of high altitude infrared emissions [PSI-G050-SR-207] N86-22032
Middle infrared emission studies in the upper atmosphere by rocket techniques N86-22033
INHOMOGENEITY
Influence of electromagnetic wave and wiggler fields inhomogeneity on a free-electron laser N86-22264
Determination of optical inhomogeneity of cylindrical bodies by light beam deflection N86-22284
INITIATORS (EXPLOSIVES)
Sensitivity of solid explosives: Minimum energy of a dangerous impact [NASA-TM-88405] N86-21703
INJECTION
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel [AD-A161652] N86-21861
INJECTION LASERS
Single-frequency CW lasing in injection laser based on terraced heterostructure with external dispersion cavity N86-22274
INJECTORS
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor [AD-A161382] N86-21580
INJURIES
Development of an ultrafast-curing wound dressing [AD-A162471] N86-22099
INSPECTION
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques [AD-A162746] N86-21710
INSTALLING
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil [AD-A162528] N86-22006
INSULATION
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
INSULATORS
Surface discharge through an insulator in a vacuum [NASA-TM-77936] N86-21756
Development of a system to produce semiconductor insulator multi-layer structures [AD-A162750] N86-22430
INTAKE SYSTEMS
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
INTEGRAL EQUATIONS
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems [AD-A161550] N86-21730
Plastic deformation on the crack line in an elastic perfectly-plastic material N86-21881
INTEGRALS
On stochastical integration by series of Wiener integrals [AD-A161514] N86-22211
INTEGRATED CIRCUITS
Point defects and dopant diffusion in silicon N86-21743
Complexity results in VLSI and distributed computing N86-21744
Performance limits of scaled CMOS analog ICs N86-21748
Interface structure and electronic properties of the titanium-silicon system N86-21749
Optically controlled phased array antenna concepts using GaAs monolithic microwave integrated circuits [NASA-TM-87229] N86-21757
Reducing memory references via effective register usage [AD-A161352] N86-21760
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits [AD-A161371] N86-21761
A simulation program with latency exploitation and node tearing [AD-A161379] N86-21762
Investigation of planar waveguides and components for millimeter-wave integrated circuits [AD-A161400] N86-21763
The area-time complexity of sorting [AD-A161562] N86-21767
Special purpose computer architecture for LU factorization of partitioned systems [AD-A161351] N86-22133
Hierarchical composition of VLSI circuits N86-22148
Minimization of a six variable boolean function [AD-A161718] N86-22166

MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
X-ray lithography: Beamline U6 N86-22332
Investigations of the etching chemistry of electronic materials N86-22347

INTEGRATED LIBRARY SYSTEMS
Dictionary machines for cube-class networks
[AD-A161393] N86-22136

INTERCALATION
A comparison of the bromination dynamics of pitch-based and vapor-grown graphite fibers
[NASA-TM-87275] N86-21683

INTERFACE STABILITY
Dynamics and stability of flows with moving contact lines N86-21787

INTERFACES
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712
Electrical cone connector
[AD-D011982] N86-21781
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
GETWRD package update: New features and modifications to the GETWRD package
[AD-A162698] N86-22179

INTERFACIAL TENSION
Damping behavior of metal matrix composites N86-21900

INTERFERENCE
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading
[AD-A162495] N86-21735

INTERFEROMETERS
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052
Optical elements formed by compressed gases: Analysis and potential applications
[NASA-TP-2555] N86-22390

INTERMETALLICS
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl N86-22366

INTERMOLECULAR FORCES
Influence of universal intramolecular interactions on laser radiation from oxazine 17 N86-22287

INTERNAL FRICTION
Characteristics of dry friction damping N86-21889
Composite material damping using impulse technique N86-21895

INTERNAL PRESSURE
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory
[AD-A161733] N86-21958

INTERNATIONAL COOPERATION
The other aspect of solar energy utilization. Solar technologies export enhancement: A central European point of view N86-21985

INTERNATIONAL LAW
Use of space dependent on development of space law
[AD-A161397] N86-22449

INTERNATIONAL RELATIONS
Use of space dependent on development of space law
[AD-A161397] N86-22449

INTERPLANETARY MAGNETIC FIELDS
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

INTERPLANETARY SPACE
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509

INTERPROCESSOR COMMUNICATION
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Study on routing and flow control in computer networks
[AD-A161768] N86-22189

INTERSECTIONS
Combining computation with geometry N86-22145

INTERSTELLAR SPACE
The X-ray spectroscopic study of the interstellar medium N86-22470

INTERVALS
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239

INVARIANCE
Invariance principles under a two-part mixing assumption
[AD-A162800] N86-22223

INVENTIONS
Apparatus for edge etching of semiconductor wafers
[NASA-TM-77998] N86-21720
Combustion engine for solid and liquid fuels
[NASA-TM-77714] N86-21855

INVENTORIES
Inventory of research grade air monitoring stations operated by European research groups
[AP-25] N86-22009

INVERSE SCATTERING
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310

INVERSIONS
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777

INVISCID FLOW
A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521

ION CURRENTS
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Study of mechanisms of ionic transport in crystalline and glassy solid electrolytes N86-21976

ION CYCLOTRON RADIATION
Plasma production with rotating ion cyclotron wave excited by Nagoya Type-3 antennas in RFC-XX
[IPPJ-752] N86-22403

ION DENSITY (CONCENTRATION)
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
A meridional circulation model to study upper atmosphere seasonal phenomena
[INPE-2716-PRE/852] N86-22058
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382

ION EXCHANGING
Improved amphoteric ion exchanger and its manufacturing method
[DE86-001608] N86-21836

ION IMPLANTATION
Modifications in microstructure, deformation and fatigue behavior by ion implantation
[AD-A161688] N86-21667

ION IRRADIATION
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431

ION SOURCES
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320

ION TEMPERATURE
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382

IONIC COLLISIONS
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297

IONIC REACTIONS
Flow of nuclear matter
[DE86-001484] N86-22384

IONIZATION
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Investigation of electroionization pulsed carbon dioxide isotope output characteristics N86-22267
High-power CO2 electric discharge laser with easily ionized substances added N86-22270
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320

IONOSPHERE
Ionospheric effects to antenna impedance
[NASA-TM-77956] N86-21727
Initial simulations of the high latitude thermosphere and ionosphere with a coupled three dimensional model N86-22039
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

IONS
Comparison of computational results of a few representative three-dimensional transonic potential flow analysis programs
[NASA-TM-77963] N86-21509
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Host materials for transition-metal ions with the ndN electronic configuration
[AD-A161782] N86-21846
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
YAG:Er3+ cross-relaxation laser N86-22277
Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297

IRON
Rapidly solidified alloys of iron-rare earth boron for permanent magnets N86-21652
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483

IRON ALLOYS
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21663

IRON COMPOUNDS
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641

IRRADIATION
Determination of Tri-n-Butyl Phosphate (TBP) in the TBP-mVarsol-HNO3 system using precision densimetry
[DE86-001607] N86-21832
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257
Intense beams of cold atoms for laser spectroscopy N86-22282

ISLANDS
Shortest paths in Euclidean space with polyhedral obstacles
[AD-A161599] N86-22212

ISOSTATIC PRESSURE
Manufacture of high-density ceramic sinters
[NASA-TM-77925] N86-21678
Capsulation of moldings made from silicon ceramic material
[NASA-TM-77933] N86-21680
Removal of glass adhered to sintered ceramics in hot isostatic pressing
[NASA-TM-77930] N86-21719
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide
[AD-A161455] N86-21955

ISOTHERMAL PROCESSES
Diffusion and defect characterization studies of mercury cadmium telluride
[AD-A162644] N86-22429

ISOTOPES
Investigation of electroionization pulsed carbon dioxide isotope output characteristics N86-22267

ISRAEL
Measurement of atmospheric transmission over long paths in the infrared spectral region
[AD-A161258] N86-22392

ITERATION
Algorithms for nonlinear programming
[AD-A161746] N86-22138

Simulations among multidimensional iterative arrays, iterative tree automata, and alternating turning machines [AD-A162661] N86-22142
Multi-Input/Multi-Output sensitivity points tuning [AD-A161641] N86-22193

ITERATIVE SOLUTION
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems [AD-A161550] N86-21730
Investigation of planar waveguides and components for millimeter-wave integrated circuits [AD-A161400] N86-21763

J

JAMMING
Adaptive antenna nulling performance in a dispersive propagation medium [AD-A162708] N86-21739

JAPAN
Japan report: Science and technology [JPRS-JST-86-001] N86-21723
Japanese Technology Evaluation Program (JTECH): Biotechnology Panel [PB86-109386] N86-22092

JET AIRCRAFT
Aircraft interior panel test criteria derived from full-scale fire tests [AD-A161637] N86-21529
F100 fuel sampling analysis [AD-A161667] N86-21707

JET ENGINE FUELS
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel [AD-A161652] N86-21861

JET ENGINES
Jet engine operating and support cost estimating relationship development [AD-A161683] N86-21547
F100 fuel sampling analysis [AD-A161667] N86-21707
Demonstration test of burner liner strain measuring system [NASA-CR-174743] N86-21817

JET FLOW
Acta mechanica sinica (Selected articles) [AD-A162726] N86-21522
Semiempirical methods for computing turbulent flows [NASA-TM-77996] N86-21795
Experimental studies on cavitation inception in a submerged jet [OUEL-1586/85] N86-21811
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object — galactic nuclei, quasars N86-22479

JOINTS (JUNCTIONS)
Finite-element analysis of adhesively bonded joints [PB86-100708] N86-21869
Characteristics of dry friction damping N86-21889
Friction damping studies at Imperial College N86-21893
Passively damped joints for advanced space structures N86-21930

JOSEPHSON JUNCTIONS
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299

JP-4 JET FUEL
Toxic hazards research unit annual technical report: 1985 [AD-A161558] N86-22097

JP-8 JET FUEL
Toxic hazards research unit annual technical report: 1985 [AD-A161558] N86-22097

JUNCTION TRANSISTORS
Numerical model and analysis of transistors with polysilicon emitters N86-21750

K

K LINES
Fragmentation of small molecules following soft X-ray absorption near the carbon K-edge N86-22333
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Photon stimulted desoprtion of ions from polymer surfaces N86-22367

KENTUCKY
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983 [PB86-910402] N86-21525

KEROSENE
Full-Scale Transport controlled Impact Demonstration [NASA-CP-2395] N86-21933

KEYING
Reconfigurable work station for a video display unit and keyboard [NASA-CASE-MFS-26009-1SB] N86-22114

KINEMATICS
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory [AD-A161733] N86-21958

KINETIC EQUATIONS
Kinetics and spectroscopy of high altitude infrared emissions [PSI-G050-SR-207] N86-22032
Effect of pulse dependent discharge on relaxing gas flow N86-22265

KINETIC THEORY
Study of the kinetics of molecular nitrogen by the method of wide-band coherent antiStokes scattering of light N86-22279

KINETICS
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen [AD-A161758] N86-21643
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration [AD-A161671] N86-21666
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide [AD-A161455] N86-21955
Investigation of fluorescence kinetics of dyes by parametric frequency conversion N86-22289
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si [AD-A161620] N86-22420

KORTEWEG-DEVRIES EQUATION
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas [IPPJ-751] N86-22402

KRYPTON FLUORIDE LASERS
Lasing of XeCl, Xe and KrF excimer moleucles in two-comonent mistures N86-22269

L

LABORATORIES
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987 [AD-A162792] N86-22443
Unclassified publications of Lincoln Laboratory, volume 10 [AD-A161752] N86-22446

LAGOONS
Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment [AD-A162516] N86-22005

LAGRANGE MULTIPLIERS
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack [AD-A162407] N86-21801

LAMINAR BOUNDARY LAYER
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction [NASA-TM-78001] N86-21791
Development of perturbations in the boundary layer [NASA-TM-77986] N86-21793
Laminar boundary layer in conditions of natural transition to turbulent flow [NASA-TM-77985] N86-21796

LAMINAR FLOW
A new method for laminar boundary layer transition visualization in flight: Color changes in liquid crystal coatings [NASA-TM-87666] N86-21518

LAMINATES
Analysis of aluminum/aramid-epoxy hybrid laminates N86-21595
Response and failure analysis of a graphite-epoxy laminate containing terminating internal plies N86-21597
Composite laminate free edge reinforcement concepts N86-21601
Influence of damage on mechanical performance of woven laminates at low temperature N86-21606
Life prediction for composite laminates using critical element concepts N86-21608
Effects of thickness and ply orientation on buckling of laminated plates [NASA-TM-87691] N86-21617
Analysis and experiments on interlaminar fracture toughness in resin matrix composites [AD-A162689] N86-21622
Buckling of laminated composite plates and shell panels [AD-A162723] N86-21623
The electroplating of laminated chromium [AD-A162751] N86-21671
Laminated damped fuselage structures N86-21916
Development of a system to produce semiconductor insulator multi-layer structures [AD-A162750] N86-22430

LAND USE
Spatial classification of urban landscapes from landcovcer probaabilities derived through remote sensing N86-21967

LANDING GEAR
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987 [AD-A162792] N86-22443

LANDSAT SATELLITES
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region [DFVLR-FB-85-49] N86-21972
Authorizing appropriations for Landsat commercialization [HR-REPT-99-177] N86-22448

LANDSAT 4
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data [NASA-CR-176660] N86-21970

LAPLACE TRANSFORMATION
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers [AD-A162508] N86-21690
The dynamics of heat transfer in a turbulent pipe flow, part 2 [OEFZS-4325-PT-2] N86-21808

LARGE SCALE INTEGRATION
Chemistry of MOS-LSI radiation hardening [NASA-CR-176651] N86-21636
Complexity results in VLSI and distributed computing N86-21744
A new implementation of the pipeline analog-to-digital conversion technique N86-21745
Functional test generation of digital LSI/VLSI systems using machine symbolic execution technique N86-22146
Hierarchical composition of VLSI circuits N86-22148

LARGE SPACE STRUCTURES
Dynamic characteristics of two 300 kW class dual keel space station concepts [NASA-TM-87680] N86-21569
Experimental-theoretical study of velocity feedback damping of structural vibrations N86-21853
An experimental study of passive damping and active control of large space structures N86-21925
Passively damped joints for advanced space structures N86-21930
Passive and Active Control Of Space Structures (PACOSS) N86-21931
The LATDYN user's manual [NASA-TM-87635] N86-21953

LASER ANEMOMETERS
A conditional sampling module for the TSI laser Doppler anemometer counter processor [AD-A161555] N86-21823

LASER APPLICATIONS
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques [AD-A162746] N86-21710
Quantum electronics in the UK, a National-Survey Conference [AD-A161623] N86-21769
Research and development of a high average power photoprocessing laser system N86-21840
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles [AD-A161333] N86-22310
Extreme ultraviolet emission spectroscopy of atoms and laser applications N86-22313
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source [AD-A162401] N86-22320
Raman heterodyne interference phenomena N86-22391

LASER CAVITIES
Hysteresis effects in Ar+ laser with nonlinear absorber in the cavity N86-22268
High-power CO2 electric discharge laser with easily ionized substances added N86-22270
Generation of picosecond pulses in monopulse-pumped dye lasers N86-22271
Wavelength switching in copper-vapor lasers N86-22275
Enhancing efficiency of atom ionization by pulsed periodic lasers N86-22285

LASER DOPPLER VELOCIMETERS
Improvements and application of a new type of three component laser Doppler velocimeter [VKI-TM-37] N86-21837

LASER MATERIALS
Host materials for transition-metal ions with the ndN electronic configuration [AD-A161782] N86-21846
Influence of universal intramolecular interactions on laser radiation from oxazine 17 N86-22287

LASER MODES
Hysteresis effects in Ar+ laser with nonlinear absorber in the cavity N86-22268
H2/F2 chemical laser initiated by excimer flashlamp N86-22276

LASER OUTPUTS
Investigation of electroionization pulsed carbon dioxide isotope output characteristics N86-22267
High-power CO2 electric discharge laser with easily ionized substances added N86-22270
Spatial, temporal and energy characteristics of copper-vapor laser radiation N86-22272
Wavelength switching in copper-vapor lasers N86-22275
Influence of universal intramolecular interactions on laser radiation from oxazine 17 N86-22287
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source [AD-A162401] N86-22320
Beam line U5: (FEL and diagnostic line) N86-22330
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349
Electron acceleration by laser fields in a gas [DE86-000983] N86-22380
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si [AD-A161620] N86-22420

LASER PLASMAS
Shockwave propagation in low-temperature carbon plasma N86-22260
Slow combustion of laser plasma and optical charges N86-22290

LASER PUMPING
High-power CO2 electric discharge laser with easily ionized substances added N86-22270
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source [AD-A162401] N86-22320

LASER SPECTROSCOPY
Study of the kinetics of molecular nitrogen by the method of wide-band coherent antiStokes scattering of light N86-22279
Intense beams of cold atoms for laser spectroscopy N86-22282

LASER TARGETS
Microcellular foams via phase separation [DE86-000784] N86-21699

LASER WEAPONS
Laser propagation code study [AD-A161370] N86-21842

LASERS
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques [AD-A162746] N86-21710
Research and development of a high average power photoprocessing laser system N86-21840
USSR report: Physics and mathematics [JPRS-UPM-86-003] N86-22254
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257
Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si [AD-A161620] N86-22420

LASING
Future possibilities of free-electron laser N86-22262

LAUNCHING
The evolution of the cruise missile [AD-A162646] N86-21538

LEACHING
Investigation of chemical durability mechanism in fluoride glasses [AD-A162740] N86-21693

LEAD (METAL)
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes [AD-A161640] N86-21641

LEADING EDGES
Acta mechanica sinica (Selected articles) [AD-A162726] N86-21522
Turbine vane external heat transfer. Volume 1: Analytical and experimental evaluation of surface heat transfer distributions with leading edge showerhead film cooling [NASA-CR-174827] N86-21546
Effects of wing modification on an aircraft's aerodynamic parameters as determined from flight data [NASA-TM-87591] N86-21550
Effect of a rotor wake on the local heat transfer on the forward half of a circular cylinder [NASA-TM-87234] N86-21794
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack [AD-A162407] N86-21801

LEAKAGE
Semiconductor laser source for natural gas leak detection [PB86-102811] N86-21849
Self-compensating solenoid valve [NASA-CASE-ARC-11620-1] N86-21859

LEARNING CURVES
A microcomputer program for the solution of learning curve computations [AD-A161648] N86-22163

LEAST SQUARES METHOD
Fast and efficient algorithms for linear programming and for the linear least squares problem [AD-A161391] N86-22161
A microcomputer program for the solution of learning curve computations [AD-A161648] N86-22163

LEG (ANATOMY)
Drop foot corrective device [NASA-CASE-LAR-12259-2] N86-22112

LENGTH
Shortest paths in Euclidean space with polyhedral obstacles [AD-A161599] N86-22212

LENSES
Optical elements formed by compressed gases: Analysis and potential applications [NASA-TP-2555] N86-22390

LEVEL (QUANTITY)
Using spectral estimation techniques in adaptive processing antenna systems [AD-A161670] N86-21732

LIAPUNOV FUNCTIONS
Distributed piezoelectric-polymer active vibration control of a cantilever beam N86-21924

LIBRARIES
GETWRD package update: New features and modifications to the GETWRD package [AD-A162698] N86-22179

LICENSING
The history of aeronautical medicine in Venezuela [NASA-TM-77709] N86-22094

LIFE (DURABILITY)
Composite laminate free edge reinforcement concepts N86-21601
Viscoelastic behavior and life-time predictions N86-21602
Life prediction for composite laminates using critical element concepts N86-21608
Lightweight nickel electrode for nickel hydrogen cells and batteries [NASA-TM-87253] N86-21978
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353

LIFE CYCLE COSTS
Development and use of the Life Cycle Cost In Design computer program (LCCID) [AD-A162522] N86-22174

LIFT
Control of missile dispersion via roll rate modulation [AD-A162542] N86-21565
Computer Controller Optical Surfacing (CCOS) lap pressure control system [AD-D011985] N86-21805

LIFT DEVICES
Procedure for utilizing the lift and thrust forces of ornithopters [NASA-TM-77682] N86-21534

LIGANDS
Particulate models of photosynthesis [DE86-001625] N86-22090

LIGHT (VISIBLE RADIATION)
X-ray holography experiments on the U15 beam line N86-22371

LIGHT BEAMS
Intense beams of cold atoms for laser spectroscopy N86-22282
Determination of optical inhomogeneity of cylindrical bodies by light beam deflection N86-22284

LIGHT EMITTING DIODES
An automated system for comprehensive assessment of visual field sensitivity [AD-A162755] N86-22104

LIGHT MODULATION
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles [AD-A161333] N86-22310
A real-time programmable optical correlator [AD-D011990] N86-22397

LIGHT SCATTERING
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses [NASA-TM-77903] N86-21841
Study of the kinetics of molecular nitrogen by the method of wide-band coherent antiStokes scattering of light N86-22279
Nonlinear optical spectroscopy of phonon polaritons N86-22280
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles [AD-A161333] N86-22310
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source [AD-A162401] N86-22320
The asymptotic behavior of an exponential-type series [AD-A162574] N86-22394

LIGHT TRANSMISSION
Laser propagation code study [AD-A161370] N86-21842
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes [AD-A161753] N86-22046

LIGHTING EQUIPMENT
Controlled impact demonstration on-board (interior) photographic system N86-21946

LIGHTNING SUPPRESSION
Weather radar studies [AD-A161622] N86-22061

LINE SPECTRA
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
The X-ray spectrum of emission line stars (superluminous and symbiotic) N86-22472

LINEAR ACCELERATORS
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser [AD-A162791] N86-22377
Recent progress of the advanced test accelerator [DE86-001578] N86-22386

LINEAR EQUATIONS
Fast and efficient algorithms for linear programming and for the linear least squares problem [AD-A161391] N86-22161

LINEAR FILTERS
On prediction of harmonizable stable processes [AD-A161412] N86-22210

LINEAR PROGRAMMING
Algorithms for nonlinear programming [AD-A161746] N86-22138
Fast and efficient algorithms for linear programming and for the linear least squares problem [AD-A161391] N86-22161
Enhancement of project prioritization goal programming formulation and code [AD-A162412] N86-22169

LINEAR SYSTEMS
Stochastic non-linear flutter of aeroelastic structures [AD-A162748] N86-21552
On a theory of control for linear systems over rings and nonlinear/time-varying systems [AD-A162680] N86-22194
Adaptive control of multivariable systems [AD-A162795] N86-22195
All-fiber-optic gyroscope with extended linear dynamic range N86-22389

LINEARITY
Linearized traveling wave amplifier with hard limiter characteristics [NASA-CASE-LEW-13981-2] N86-21742
The RANDOM computer program: A linear congruential random number generator [NASA-CR-176664] N86-22152

Random integral representations for classes of limit distributions similar to Levy class L(O)
[AD-A161413] N86-22235

LINEARIZATION
Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
Finite element method analysis of nonlinear continua using stochastic equivalent linearization technique N86-22202
Comment on: Identification in the linear errors in variable models
[FEW-159] N86-22225

LININGS
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
Photon desorption studies of synchrotron materials N86-22339

LINKAGES
Simulation of motions of satellites carrying a deployable flexible linkage N86-21568

LIPIDS
Proceedings: Protons and Membrane Reactions held at Santa Barbara, California on 28 January - 1 February 1985
[AD-A161331] N86-22082
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants
[AD-A162444] N86-22085

LIQUID ALLOYS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

LIQUID CHROMATOGRAPHY
Microvoltammetric electrodes
[AD-A161653] N86-21642
Development of LC-13C NMR
[NASA-CR-176656] N86-21704

LIQUID CRYSTALS
A new method for laminar boundary layer transition visualization in flight: Color changes in liquid crystal coatings
[NASA-TM-87666] N86-21518
Infrared diagnosis using liquid crystal detectors
[NASA-TM-77999] N86-21815
A real-time programmable optical correlator
[AD-D011990] N86-22397

LIQUID METALS
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560

LIQUID NITROGEN
Electrical conductivity measurements in shock compressed liquid nitrogen
[DE86-001575] N86-21783

LIQUID OXYGEN
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857

LIQUID PHASES
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Microcellular foams via phase separation
[DE86-000784] N86-21699
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353

LIQUID ROCKET PROPELLANTS
Experimental studies on the reaction kinetics of 1,1-dimethylhydrazine and oxygen
[NASA-TM-77947] N86-21630

LIQUID SLOSHING
Fluid slosh studies for spinning spacecraft
[ONERA-RT-8/3269-SY] N86-21807

LIQUID SURFACES
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

LIQUID-GAS MIXTURES
Burger's equation and shock waves propagating within liquid-gas mixtures
[AD-A161554] N86-21800

LIQUID-LIQUID INTERFACES
Dynamics and stability of flows with moving contact lines N86-21787

LIQUIDS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
New proposed dynamic vibration absorbers for excited structures N86-21908

LITHIUM
Electrolyte for lithium-inorganic non-aqueous rechargeable cell system and rechargeable cell system including said electrolyte
[AD-D011976] N86-21647

LITHIUM ALLOYS
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl N86-22366

LITHIUM FLUORIDES
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712

LITHIUM IODATES
A study on inclusion formation mechanism in alpha-LiIO sub 3 crystals
[NASA-TM-77943] N86-22417

LITHOSPHERE
Constraints on lithospheric structure from satellite potential field data: Africa and Asia. Analysis and interpretation of MAGSAT anomalies over North Africa
[NASA-CR-176611] N86-21968

LOADING MOMENTS
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950

LOADING RATE
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697

LOADS (FORCES)
Effects of thickness and ply orientation on buckling of laminated plates
[NASA-TM-87691] N86-21617
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
Structural loads preliminary results N86-21940
Controlled impact demonstration airframe bending bridges N86-21943
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory
[AD-A161733] N86-21958
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965

LOCKHEED AIRCRAFT
Aircraft accident report: Galaxy Airlines, Inc., Lockheed Electra-L-188C, N5532, Reno, Nevada, January 21, 1985
[PB86-910401] N86-21526

LOGISTICS
Maintenance planning for the 1990's (initial planning)
[PB86-106010] N86-22065

LONG DURATION SPACE FLIGHT
Design and fabrication of a long-life Stirling cycle cooler for space appliction. Phases 1 and 2: Engineering model
[NASA-CR-175288] N86-21714

LONG TERM EFFECTS
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715
Five year program strategy for Great Lakes National Program Office, 1986-1990
[PB86-107984] N86-22080

LOSS OF COOLANT
Basic principles of the Stirling cycle N86-21717

LOW ALTITUDE
Weather radar studies
[AD-A161622] N86-22061

LOW ASPECT RATIO
Improvement of damping in fiber reinforced polymer composites N86-21898

LOW ASPECT RATIO WINGS
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258

LOW NOISE
Low-noise phase/frequency detector
[AD-A161394] N86-21821

LOW PASS FILTERS
Digital filtering and acceleration pulse interpretation N86-21941

LOW TEMPERATURE
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162526] N86-22006
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420

LUBRICATION
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether
[NASA-TM-87260] N86-21575
A new chromium carbide-based tribological coating for use to 900 deg C with particular reference to the Stirling engine
[NASA-TM-87274] N86-21682
Piezoviscous effects in nonconformal contacts lubricated hydrodynamically
[NASA-TM-87141] N86-21797

LUMINESCENCE
Re-evaluation of surface properties of oxide-cathode materials
[AD-A161131] N86-21687
Influence of universal intramolecular interactions on laser radiation from oxazine 17 N86-22287
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432

LUMINOSITY
Earthquake light
[AD-A161385] N86-22042

LUNAR COMPOSITION
Extraction of information from major element chemical analyses of lunar basalts N86-22514

LUNAR CRATERS
Meteorite craters
[NASA-TM-78013] N86-22507

LUNAR LANDING SITES
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Regolith erosion and regolith mixing at the Apollo 15 site on the moon N86-22511
Apollo 15 mare units and their petrogenesis N86-22512
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513
Extraction of information from major element chemical analyses of lunar basalts N86-22514
Apollo 15 mare volcanism: Constraints and problems N86-22515
Hadley Rille, lava tubes and mare volcanism at the Apollo 15 site N86-22516
The geologic history of quartz-normative and olivine-normative basalts in the vicinity of Hadley Rille (Apollo 15) N86-22517
Chemical components of the Apollo 15 regolith N86-22518
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519
Ultramafic parent magmas for mare basalts? N86-22520
Spectral reflectance study of the Hadley-Appenine (Apollo 15) region N86-22521
Samples at the Apollo 15 landing site: Types and distribution N86-22522
Apollo 15 mare basalts: A diverse suite or two distinct groups? N86-22523
Apollo 15 regolith breccias and soils: Comparative petrology and chemistry N86-22524
The materials and formation of the imbrium basin N86-22525
The Apennine Bench Formation revisited N86-22526
Some observations on the geology of the Apollo 15 landing site N86-22527
The origin of pristine KREEP: Effects of mixing between ur KREEP and the magmas parental to the MG-rich cumulates N86-22528
Geologic setting of the Apollo 15 landing site N86-22529
Selection of the Apollo 15 landing site N86-22530

LYMPHOCYTES
Lymphocyte activation - regulatory substances
[AD-A162683] N86-22087

M

MACH-ZEHNDER INTERFEROMETERS
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[DFVLR-FB-85-56] N86-22399

MACHINING
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862

MAGELLANIC CLOUDS
Soft X-ray maps of the Large Magellanic Cloud (LMC) N86-22480

MAGMA
Ultramafic parent magmas for mare basalts? N86-22520

MAGNESIUM
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349

MAGNETIC ANOMALIES
Constraints on lithospheric structure from satellite potential field data: Africa and Asia. Analysis and interpretation of MAGSAT anomalies over North Africa
[NASA-CR-176611] N86-21968
MAGNETIC BEARINGS
A small free-piston Stirling refrigerator N86-21716
MAGNETIC DISTURBANCES
A search for outflows from X-ray bright points in coronal holes
[NASA-CR-176647] N86-22458
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
MAGNETIC FIELDS
Chaos and nonlinear dynamics of single-particle orbits in a magnetotail-like magnetic field
[AD-A161750] N86-22045
Modulation of IR lasers by semiconducting plasma N86-22256
Equilibrium states of charged electron beams and space charge compensation processes N86-22292
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
Plasma flows in divertor regions of Vint-20 single-pass torsatron N86-22296
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
Magnetic systems for fusion devices
[DE86-000743] N86-22407
A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423
MAGNETIC MATERIALS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
MAGNETIC MONOPOLES
A relativistic rotating massive object with saturation of magnetic monopoles --- galactic nuclei, quasars N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object --- galactic nuclei, quasars N86-22479
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536
MAGNETIC PROPERTIES
Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851
MAGNETIC SPECTROSCOPY
Spectral imaging with a CID camera
[AD-A161608] N86-21824
MAGNETIC STORMS
Dynamical plasmapause positions during the July 29-31/1977 storm period: A comparison of observations and time dependent model calculations
[AERONOMICA-ACTA-A-299-1985] N86-22020
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
MAGNETIC TAPES
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
MAGNETO-OPTICS
A real-time programmable optical correlator
[AD-D011990] N86-22397
MAGNETOACOUSTIC WAVES
Measurements of magnetoacoustic waves in MHD plasmas N86-22400
MAGNETOHYDRODYNAMIC FLOW
A meridional circulation model to study upper atmosphere seasonal phenomena
[INPE-2716-PRE/852] N86-22058
Plasma flows in divertor regions of Vint-20 single-pass torsatron N86-22296
MAGNETOHYDRODYNAMIC GENERATORS
Measurements of magnetoacoustic waves in MHD plasmas N86-22400
A pulsed magnetohydrodynamic generator with a superconducting magnetic system
[AD-A161812] N86-22405
MAGNETOHYDRODYNAMIC STABILITY
Analytic theory of the nonlinear M = 1 tearing mode
[DE86-001783] N86-22412
MAGNETOHYDRODYNAMIC WAVES
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382
MAGNETOHYDRODYNAMICS
Far infrared diagnostics of electron concentration in combustion MHD plasmas using interferometry and Faraday rotation N86-22401
MAGNETOPAUSE
Plasmoid motion across a tangential discontinuity (with application to the magnetopause)
[AERONOMICA-ACTA-A-297-1985] N86-22019
MAGNETOSONIC RESONANCE
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas
[IPPJ-751] N86-22402
MAGNETOSPHERE
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
MAGNETS
Rapidly solidified alloys of iron-rare earth boron for permanent magnets N86-21652
MAINTENANCE
Maintenance planning for the 1990's (initial planning)
[PB86-106010] N86-22065
MAN MACHINE SYSTEMS
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
The Statistical Analysis Program Package (SAPP): A special data analysis program
[OEFZS-4326] N86-22248
MANAGEMENT
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
MANAGEMENT INFORMATION SYSTEMS
Advanced Technology Unit Training and Management System (ATUTMS). User's guide
[NASA-CR-176643] N86-22130
MANAGEMENT METHODS
An organizational development handbook
[AD-A161414] N86-22438
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
MANAGEMENT PLANNING
An organizational development handbook
[AD-A161414] N86-22438
MANGANESE
Resonance valence-band photoemission and h Nu dependent 3p photoemission of MnF2 N86-22368
MANIPULATORS
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865
The synthesis of force closure grasps in the plane
[AD-A162635] N86-21866
MANNED SPACE FLIGHT
Manned spaceflight in the nineties: The European perspective
[NASA-TM-77697] N86-21561
MANUFACTURING
Silicon carbide sintered products and a method for their manufacturing
[NASA-TM-77932] N86-21679
Light weight aluminum optics --- spaceborne x-ray astronomy applications N86-22487
MAPPING
Architectural elements for bitmap graphics N86-22127
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
Representation of urban districts in a geographical information system
[PB86-109451] N86-22455
MAPS
Geonames processing system functional design specification. Volume 3: Advanced type placement
[AD-A162552] N86-22175
MARIA
The geologic history of quartz-normative and olivine-normative basalts in the vicinity of Hadley Rille (Apollo 15) N86-22517
Chemical components of the Apollo 15 regolith N86-22518
Apollo 15 mare basalts: A diverse suite or two distinct groups? N86-22523
Some observations on the geology of the Apollo 15 landing site N86-22527
The origin of pristine KREEP: Effects of mixing between ur KREEP and the magmas parental to the MG-rich cumulates N86-22528
MARINE ENVIRONMENTS
Prototype salvage foaming system
[AD-A161499] N86-21688
Inventory of non-federally funded marine pollution research, development and monitoring activities: Great Lakes region
[PB86-102308] N86-22012
MARINE METEOROLOGY
Mariners Weather Log, Volume 29, Number 3: Summer, 1985
[PB86-108313] N86-22066
Pacific Marine Environmental Laboratory
[PB86-105525] N86-22078
MARKERS
A methodology for applying bar code technology to Aircraft Maintenance Unit support sections
[AD-A161783] N86-22441
MARKOV CHAINS
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Markov chains with rare transitions and simulated annealing
[AD-A161598] N86-22237
MARKOV PROCESSES
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
The reduction of perturbed markov generators: An algorithm exposing the role of transient states
[AD-A162773] N86-22219
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Markov chains with rare transitions and simulated annealing
[AD-A161598] N86-22237
An optimal repartitioning decision policy
[NASA-CR-178035] N86-22250
A hierarchical approach to reliability modeling of fault-tolerant systems
[NASA-CR-176654] N86-22251
MARTENSITIC TRANSFORMATION
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21663
MASERS
High voltage K sub a -band gyrotron experiment
[AD-A161686] N86-21845
MASS SPECTRA
Automated instrument for qualitative analysis of photographically recorded spectra
[DE86-001621] N86-21833
MASS SPECTROSCOPY
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
MASS TRANSFER
Microvoltammetric electrodes
[AD-A161653] N86-21642
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction
[NASA-TM-78001] N86-21791
MATERIALS HANDLING
NBS (National Bureau of Standards): Materials measurements
[NASA-CR-176646] N86-21648
Fiber reinforced plastics described N86-21725

Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005

MATERIALS TESTS
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697

MATHEMATICAL LOGIC
Temporal reasoning and default logics
[AD-A162447] N86-22170

MATHEMATICAL MODELS
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
Numerical model and analysis of transistors with polysilicon emitters N86-21750
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965
Green River air quality model development. VALMET: A valley air pollution model
[PB86-104106] N86-22013
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
Second order approximations N86-22122
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234
Bootstrapping Cox's regression model
[AD-A162443] N86-22241
M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
Models for the oxidation of silicon
[AD-A161751] N86-22424

MATRICES (MATHEMATICS)
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
An algebraic syndrome decoding technique for certain convolutional codes
[AD-A162636] N86-22177
The role of the topological distance matrix in chemistry
[AD-A162523] N86-22252
On measures of nonnormality of matrices
[FEW-167] N86-22253

MATRIX MATERIALS
Fatigue response of silicon carbide whisker/aluminum matrix composites N86-21591
Thermoplastic matrix composite processing model
[NASA-CR-176639] N86-21619
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692
Experimental measurement of material damping for space structures N86-21887

MATRIX METHODS
Experimental measurement of material damping for space structures N86-21887

MATTER (PHYSICS)
Flow of nuclear matter
[DE86-001484] N86-22384

MAXIMUM LIKELIHOOD ESTIMATES
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234
Investigations on statistics of terrain height
[AD-A162517] N86-22243

MAXWELL-BOLTZMANN DENSITY FUNCTION
Fractional calculus to represent complex modulus N86-21885

MEASURING INSTRUMENTS
Claw grip contact probe for flat packs
[AD-D011997] N86-21782
Safeguards instrumentation: A computer-based catalog, second edition
[DE86-000840] N86-21835

MECHANICAL ENGINEERING
Combining computation with geometry N86-22145

MECHANICAL PROPERTIES
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Containerless high purity pulling process and apparatus for glass fiber
[NASA-CASE-MFS-25905-2] N86-21718
Silicon oxidation studies. Silicon orientation effects on thermal oxidation
[AD-A161633] N86-22421

MEDICAL EQUIPMENT
Drop foot corrective device
[NASA-CASE-LAR-12259-2] N86-22112

MELT SPINNING
Undercooled and rapidly quenched Ni-Mo alloys
[NASA-TM-87257] N86-21659

MELTS (CRYSTAL GROWTH)
Containerless high purity pulling process and apparatus for glass fiber
[NASA-CASE-MFS-25905-2] N86-21718

MEMBRANE STRUCTURES
A large strain finite element formulation for one dimensional membrane elements — soil mechanics
[OUEL-1603/85] N86-22228

MEMBRANES
Proceedings: Protons and Membrane Reactions held at Santa Barbara, California on 28 January - 1 February 1985
[AD-A161331] N86-22082

MEMORY
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820

MENTAL HEALTH
The history of aeronautical medicine in Venezuela
[NASA-TM-77709] N86-22094

MENTAL PERFORMANCE
Temporal reasoning and default logics
[AD-A162447] N86-22170

MERCURY CADMIUM TELLURIDES
Diffusion and defect characterization studies of mercury cadmium telluride
[AD-A162644] N86-22429

MESONS
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381
LAMPF: Its origins, history, and accomplishments
[DE86-000814] N86-22383

MESOSPHERE
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052

MESSAGE PROCESSING
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
Sequential decoding for multiple access channels
[AD-A162630] N86-21738
ASIM (Automated interactive simulation modeling system) VAX version user's manual
[AD-A161556] N86-22162
GETWRD package update: New features and modifications to the GETWRD package
[AD-A162698] N86-22179

METABOLISM
Mechanisms of bioenergetic homeostasis during exercise: A general model
[AD-A161678] N86-22098

METAL COATINGS
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956

METAL FATIGUE
Modifications in microstructure, deformation and fatigue behavior by ion implantation
[AD-A161688] N86-21667
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963

METAL FILMS
Polyimide and the polymer-metal interaction N86-22346

METAL IONS
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320

METAL JOINTS
Tool and process for explosive joining of tubes
[NASA-CASE-LAR-13309-1] N86-21858

METAL MATRIX COMPOSITES
Vibration Damping 1984 Workshop Proceedings
[AD-A152547] N86-21883
Improved extensional modulus measurements for polymers and metal matrix composites N86-21896
Damping behavior of metal matrix composites N86-21900
Damping in metal-matrix composites: Measurement and modeling N86-21901

METAL OXIDE SEMICONDUCTORS
Chemistry of MOS-LSI radiation hardening
[NASA-CR-176651] N86-21636
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits
[AD-A161371] N86-21761
Time and frequency dependent behavior of a two dimensional electron gas at long wavelengths
[AD-A162546] N86-21773

METAL PARTICLES
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624

METAL POWDER
The 3rd National Conference on Metallic Powder Study was held in An-Shan
[AD-A162408] N86-21669

METAL SURFACES
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Development of shearographic imaging system
[AD-A161819] N86-21826
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
Surface states on simple metal surfaces N86-22328

METAL VAPOR LASERS
Spatial, temporal and energy characteristics of copper-vapor laser radiation N86-22272
Wavelength switching in copper-vapor lasers N86-22275

METALS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
Polyimide and the polymer-metal interaction N86-22346

METASTABLE STATE
Electron microscopic determination of the metastable dissociation region in the system Li sub 2SiO3-SiO sub 2
[NASA-TM-77980] N86-21681

METEORITE CRATERS
Meteorite craters
[NASA-TM-78013] N86-22507

METEOROIDS
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052

METEOROLOGICAL FLIGHT
Relative accuracy of ALPEX aircraft data: An evaluation of the ALPEX intercomparison flight with the NCAR (National Center for Atmospheric Research) Electra, the NOAA (National Oceanic and Atmospheric Administration P3 and the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft-und Raumfahrt) Falcon
[PB86-100823] N86-22067

METEOROLOGICAL PARAMETERS
Relative accuracy of ALPEX aircraft data: An evaluation of the ALPEX intercomparison flight with the NCAR (National Center for Atmospheric Research) Electra, the NOAA (National Oceanic and Atmospheric Administration P3 and the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft-und Raumfahrt) Falcon
[PB86-100823] N86-22067

METEOROLOGICAL RADAR
Weather radar studies
[AD-A161622] N86-22061

METEOROLOGICAL RESEARCH AIRCRAFT
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[DFVLR-FB-85-50] N86-21541

The icing research aircraft DO28, D-IFMP of DFVLR, and its measuring equipment
[DFVLR-MITT-85-12] N86-22064

Relative accuracy of ALPEX aircraft data: An evaluation of the ALPEX intercomparison flight with the NCAR (National Center for Atmospheric Research) Electra, the NOAA (National Oceanic and Atmospheric Administration P3 and the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer Luft-und Raumfahrt) Falcon
[PB86-100823] N86-22067

METEOROLOGICAL SATELLITES
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048

METEOROLOGICAL SERVICES
Inventory of research grade air monitoring stations operated by European research groups
[AP-25] N86-22009

METEOROLOGY
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024

NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054

METEOSAT SATELLITE
METEOSAT operational programme: Radiometer imaging electronics radiation analysis
[MTO-51F00-031] N86-21754

METHANE
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635

METHOD OF MOMENTS
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems
[AD-A161550] N86-21730

METHYL COMPOUNDS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

Vertical distribution of acetonitrile in the atmosphere
[AERONOMICA-ACTA-A-300-1985] N86-22021

VUV optical properties of cadmium dimethyl N86-22354

MICE
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086

MICROCOMPUTERS
Spectral imaging with a CID camera
[AD-A161608] N86-21824

A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163

Contact X-ray microscopy of biological materials N86-22370

MICROELECTRONICS
Microvoltammetric electrodes
[AD-A161653] N86-21642

An analysis of foreign source dependence for critical microcircuits of USAF avionics components
[AD-A161311] N86-22436

MICROMETEOROLOGY
Data analysis of the NOAA-GIT (National Oceanic and Atmospheric Administration-Georgia Institute of Technology) millimeter-wave propagation experiment near Faltville, Illinois
[AD-A161722] N86-21733

MICROORGANISMS
Research projects of the Water Resources Research Institute during FY 1983
[PB86-101235] N86-21973

MICROPHONES
An experimental appraisal of the use of ground-plane microphones for aircraft noise measurement --- certification tests
[NPL-AC-104] N86-22302

MICROPROCESSORS
Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765

Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979

MICROSCOPES
Characterization of vesicle and microemulsion microstructures
[AD-A161459] N86-21639

MICROSCOPY
Contact X-ray microscopy of biological materials N86-22370

X-ray holography experiments on the U15 beam line N86-22371

Scanning soft X-ray microscopy on the U15 beam line N86-22372

MICROSTRUCTURE
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573

Chemical modification of matrix resin networks with engineering thermoplastics: Morphology and properties of poly(aryl ether sulfone) modified epoxy networks N86-21613

Characterization of vesicle and microemulsion microstructures
[AD-A161459] N86-21639

Crack initiation and microstructure in tungsten carbide-cobalt composites N86-21651

A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653

Variables controlling fatigue crack growth of short cracks
[NASA-TM-87208] N86-21661

Modifications in microstructure, deformation and fatigue behavior by ion implantation
[AD-A161688] N86-21667

Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694

Amphibole ceramics: Conceptual development and preliminary experiments
[DE86-001445] N86-21700

Characterization of plasma-sprayed ferrite coatings N86-21854

Damping behavior of metal matrix composites N86-21900

The use of quantitative databases in Aladin, an alloy design system
[AD-A162555] N86-22176

A computer simulation study of the microscopic structure of a typical current sheet in the solar wind
[AERONOMICA-ACTA-A-301-1985] N86-22533

MICROWAVE CIRCUITS
Low loss dielectrics with controllable values of specific permittivity --- microwave circuit fillers
[DRIC-T-7632] N86-21752

Optically controlled phased array antenna concepts using GaAs monolithic microwave integrated circuits
[NASA-TM-87229] N86-21757

MICROWAVE EQUIPMENT
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777

A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423

MICROWAVE RADIOMETERS
METEOSAT operational programme: Radiometer imaging electronics radiation analysis
[MTO-51F00-031] N86-21754

MICROWAVES
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624

MIGRATION
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410

MILITARY AIR FACILITIES
Development and use of the Life Cycle Cost in Design computer program (LCCID)
[AD-A162522] N86-22174

MILITARY OPERATIONS
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

MILITARY TECHNOLOGY
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540

MILLIMETER WAVES
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624

An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728

Data analysis of the NOAA-GIT (National Oceanic and Atmospheric Administration-Georgia Institute of Technology) millimeter-wave propagation experiment near Faltville, Illinois
[AD-A161722] N86-21733

Investigation of planar waveguides and components for millimeter-wave integrated circuits
[AD-A161400] N86-21763

Semiconductor millimeter wavelength electronics
[AD-A162566] N86-22427

MIM (SEMICONDUCTORS)
Metal-insulator transition on the Ge(001) surface N86-22327

Thin-film chemical sensors based on electron tunneling
[NASA-CR-176662] N86-22418

MINERALOGY
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data
[NASA-CR-176660] N86-21970

MINIATURIZATION
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694

MINICOMPUTERS
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158

Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437

MIRROR FUSION
Magnetic systems for fusion devices
[DE86-000743] N86-22407

MIRRORS
Spectral imaging with a CID camera
[AD-A161606] N86-21824

Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286

Reflectance measurements of aluminum coatings at 200 - 500 nm N86-22351

Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382

Method of determining the thermal deformations of astronomical mirrors
[NASA-TM-77941] N86-22457

Light weight aluminum optics --- spaceborne x-ray astronomy applications N86-22487

The LAMAR telescope module for high throughput imaging and spectroscopy --- Large Area Modular Array of Reflectors (LAMAR) N86-22488

A thin foil high throughput X-ray telescope N86-22489

Electroform replication of grazing incidence X-ray optics --- spaceborne telescopes N86-22491

Measurements of intrinsic width and mosaicity of test crystals with a novel four-crystal X-ray spectrometer --- spaceborne astronomy N86-22494

Measurements of surface scattering from mirrored surfaces using a triple axis X-ray spectrometer --- X ray telescope development N86-22495

MISSILE CONTROL
Control of missile dispersion via roll rate modulation
[AD-A162542] N86-21565

MISSION PLANNING
Selection of the Apollo 15 landing site N86-22530

MIXING
Invariance principles under a two-part mixing assumption
[AD-A162800] N86-22223

MODAL RESPONSE
Quasi-modal vibration control by means of active control bearings
[NASA-TM-87232] N86-21856
Damping measurement by dynamic stiffness methods N86-21902
A comparison of measured spacecraft modal damping values N86-21903
Finite element design of viscoelastically damped structures N86-21910
An experimental study of passive damping and active control of large space structures N86-21925
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928
Flexible structure control in the frequency domain N86-21929

MODELS
EPA (Environmental Protection Agency) oxidant model: Description and evaluation plan
[PB86-103090] N86-22016
Particulate models of photosynthesis
[DE86-001625] N86-22090
Some aspects of the phenomenological and microscopic theory of nuclear collective motion N86-22374
Regolith erosion and regolith mixing at the Apollo 15 site on the moon N86-22511
The geologic history of quartz-normative and olivine-normative basalts in the vicinity of Hadley Rille (Apollo 15) N86-22517

MODEMS
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158

MODES
Effects of waveguide modes on the scattering of a finite tubular cylinder
[AD-A161500] N86-21729

MODULATION
Modulation of IR lasers by semiconducting plasma N86-22256

MODULATION TRANSFER FUNCTION
Determination of the modulation transfer function of line scanned infrared imaging systems
[AD-A161521] N86-21822

MODULES
A conditional sampling module for the TSI laser Doppler anemometer counter processor
[AD-A161555] N86-21823
BUILD: A tool for maintaining consistency in modular systems
[AD-A162744] N86-22180

MODULUS OF ELASTICITY
Fractional calculus to represent complex modulus N86-21885
Improved extensional modulus measurements for polymers and metal matrix composites N86-21896
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897
Damping behavior of metal matrix composites N86-21900

MOIRE INTERFEROMETRY
Boundary layer effects in nearly incompressible cracked bodies N86-21605

MOISTURE
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176656] N86-22024

MOISTURE CONTENT
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861

MOLDING MATERIALS
Capsulation of moldings made from silicon ceramic material
[NASA-TM-77933] N86-21680
Fiber reinforced plastics described N86-21725

MOLECULAR BEAM EPITAXY
Gallium Arsenide structures and interfaces formed by molecular beam epitaxy N86-21747

MOLECULAR COLLISIONS
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/)
[DE86-001480] N86-22322
Energy flow in van der Waals molecules N86-22361

MOLECULAR EXCITATION
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038
Plasma processes in the excitation of Herbig-Haro objects
[TRITA-EPP-84-09] N86-22413

MOLECULAR FLOW
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043

MOLECULAR GASES
Study of the kinetics of molecular nitrogen by the method of wide-band coherent antiStokes scattering of light N86-22279
Diagnosis of populations and relaxation processes of vibrational and rotational states of moleucles in gases by coherent anti-Stokes scattering spectroscopy N86-22281

MOLECULAR INTERACTIONS
Influence of universal intramolecular interactions on laser radiation from oxazine 17 N86-22287

MOLECULAR OSCILLATIONS
Average collisional vibrational energy transfer quantities. The exponential model
[AD-A161814] N86-22319
Squeezable tunnel junctions
[AD-A161537] N86-22419

MOLECULAR RELAXATION
Diagnosis of populations and relaxation processes of vibrational and rotational states of moleucles in gases by coherent anti-Stokes scattering spectroscopy N86-22281

MOLECULAR ROTATION
Diagnosis of populations and relaxation processes of vibrational and rotational states of moleucles in gases by coherent anti-Stokes scattering spectroscopy N86-22281

MOLECULAR STRUCTURE
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
Investigations of the structure and electromagnetic interaction of few-body systems
[DE86-001659] N86-22323
Photoelectron spectroscopy of autoionizing Rydburg states in small molecules N86-22362

MOLECULES
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Bimane derivatives as fluorescent probes for biological macromolecules
[AD-A162725] N86-22088
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297
Electronic energy transfer among complex molecules N86-22316
Fragmentation of small molecules following soft X-ray absorption near the carbon K-edge N86-22333

MOLYBDENUM
Role of molybdenum in the Na sub 2SO sub 4 induced corrosion of superalloys at high temperatures
[NASA-TM-87235] N86-21658

MOLYBDENUM ALLOYS
Undercooled and rapidly quenched Ni-Mo alloys
[NASA-TM-87257] N86-21659
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

MOMENTUM TRANSFER
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities
[NAL-TR-866T] N86-22314
Fusion and fission studies for the system S-32 + U-238 N86-22404

MONATOMIC GASES
Surface analysis of space telescope material specimens
[NASA-CR-178712] N86-22460

MONITORS
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158

MONOCHROMATORS
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios
[DE86-000789] N86-21834
Reflectance measurements of aluminum coatings at 200 - 500 nm N86-22351

MONTE CARLO METHOD
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Monte Carlo calculations on the direct cable drive due to gamma radiation
[AD-A161734] N86-22375

MORPHOLOGY
Fracture morphology of 2-D carbon-carbon composition N86-21599
Controlled powder morphology experiments in megabar 304 stainless steel compaction
[DE86-002416] N86-21672
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
Morphological stability of continuous intergranular phases
[DE86-001483] N86-21701
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431

MOTION
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
ANIMAC: A multiprocessor architecture for real time computer animation N86-22149

MOTION SICKNESS
Vection-induced gastric dysrhythmias and motion sickness
[NASA-CR-176620] N86-22095
Electrodermal changes corresponding to the degree of discomfort induced by motion sickness
[NAL-TR-880] N86-22096

MOTION SIMULATION
Simulation of motions of satellites carrying a deployable flexible linkage N86-21568
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
Shortest paths in Euclidean space with polyhedral obstacles
[AD-A161599] N86-22212

MOVING TARGET INDICATORS
Two new approximate solution techniques for a moving target problem when searcher motion is constrained
[AD-A162491] N86-22171

MULTIPLE ACCESS
Sequential decoding for multiple access channels
[AD-A162630] N86-21738

MULTIPLE BEAM INTERVAL SCANNERS
Adaptive antenna nulling performance in a dispersive propagation medium
[AD-A162708] N86-21739

MULTIPLEXING
A multiplex coding imaging spectrometer for X-ray astronomy N86-22501

MULTIPROCESSING (COMPUTERS)
A coherent VLSI design environment
[AD-A161743] N86-21771
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor
[DE86-001461] N86-22143
ANIMAC: A multiprocessor architecture for real time computer animation N86-22149

MULTISPECTRAL TRACKING TELESCOPES
Multispectral glancing incidence X-ray telescope
[NASA-CASE-MFS-28013-1] N86-22459

MULTISTATIC RADAR
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052

MULTIVARIATE STATISTICAL ANALYSIS
Adaptive control of multivariable systems
[AD-A162795] N86-22195
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234
The Statistical Analysis Program Package (SAPP): A special data analysis program
[OEFZS-4326] N86-22248

MUSCULOSKELETAL SYSTEM
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109

MYOELECTRICITY
Vection-induced gastric dysrhythmias and motion sickness
[NASA-CR-176620] N86-22095

N

NACELLES
Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514
NARROWBAND
Spectral imaging with a CID camera
[AD-A161608] N86-21824
NASA PROGRAMS
NASA's long range plans
[GPO-55-035] N86-22435
NASA patent abstracts bibliography: A continuing bibliography. Section 2: Indexes (supplement 28)
[NASA-SP-7039(28)] N86-22444
Scientific and technical information output of the Langley Research Center for Calendar Year 1985
[NASA-TM-87655] N86-22445
Capabilities of spectroscopy in the context of X-ray astronomy in the 1900's — spaceborne astronomy N86-22462
NASTRAN
An experimental study of passive damping and active control of large space structures N86-21925
NATURAL GAS
Semiconductor laser source for natural gas leak detection
[PB86-102811] N86-21849
NAVIER-STOKES EQUATION
A new parabolized Navier-Stokes scheme for hypersonic reentry flows N86-21501
Numerical simulation of vortex breakdown
[NASA-TM-77951] N86-21789
Soliton turbulence
[NASA-CR-3969] N86-22056
NAVIGATION
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
NECK (ANATOMY)
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
NEGATIVE IONS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
NEODYMIUM
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257
NEODYMIUM LASERS
Slow combustion of laser plasma and optical charges N86-22290
NETHERLANDS
Space research in the Netherlands N86-22456
NETWORK ANALYSIS
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
NETWORK CONTROL
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
NETWORK SYNTHESIS
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
NEUROLOGY
European Science Notes. Volume 39, number 12
[AD-A161069] N86-21721
NEUROMUSCULAR TRANSMISSION
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
NEUROPHYSIOLOGY
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100
NEUTRINOS
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536
NEUTRON BEAMS
Radiative neutron capture by deuterum N86-22325
NEUTRON STARS
Accreting neutron stars in close binary systems N86-22468
The X-ray spectra of bursting neutron stars: Effects of Comptonization and bound-free opacity N86-22475
NICKEL
A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653
Erosion-resistant TIB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
NICKEL ALLOYS
Undercooled and rapidly quenched Ni-Mo alloys
[NASA-TM-87257] N86-21659
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21683
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965
NICKEL HYDROGEN BATTERIES
Lightweight nickel electrode for nickel hydrogen cells and batteries
[NASA-TM-87253] N86-21978
NIGHTGLOW
Spectroscopic observations of the aurora and nightglow at Svalbard N86-22028
The nightglow hydroxl (8-3) band emission: A comparison of experiment and theory N86-22031
Observations of auroral and airglow spectra using a grating spectrometer with an imaging photon detector N86-22041
NIOBIUM
Ni, Pd and Pt overlayers on Ta(110) N86-22341
KNbO3 single crystal growth by the radio frequency heating Czochralski method
[NASA-TM-77944] N86-22416
NIOBIUM ALLOYS
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
NIOBIUM CARBIDES
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide
[AD-A161455] N86-21955
NIOBIUM STANNIDES
A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423
NITRIC ACID
Determination of Tri-n-Butyl Phosphate (TBP) in the TBP-mVarsol-HNO3 system using precision densimetry
[DE86-001607] N86-21832
NITRIC OXIDE
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide
[AD-A162694] N86-21645
Analysis of nitric oxide fluorescence bands from high latitude rocket observations of the thermospheric dayglow N86-22018
NITRIDES
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
NITROGEN
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038
Study of the kinetics of molecular nitrogen by the method of wide-band coherent antiStokes scattering of light N86-22279
NITROGEN METABOLISM
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content
[AD-A161811] N86-22083
NITROGEN OXIDES
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Burner technology bulletin: Control of NOx emissions from residential gas appliances
[PB86-103892] N86-21873
National acid precipitation assessment program emission inventory allocation factors
[PB86-104247] N86-22010
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318
NOCTURNAL VARIATIONS
Spectroscopic observations of the aurora and nightglow at Svalbard N86-22028
NODES (STANDING WAVES)
A simulation program with latency exploitation and node tearing
[AD-A161379] N86-21762
NOISE (SOUND)
Coherent large-scale structures in high Reynolds number supersonic jets
[NASA-CR-3952] N86-22303
NOISE INTENSITY
Airport-Noise Levels and Annoyance Model (ALAMO) user's guide
[NASA-TM-87695] N86-22304
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
An evaluation of study design for estimating a time-of-day noise weighting
[NASA-CR-178062] N86-22306
NOISE MEASUREMENT
An experimental appraisal of the use of ground-plane microphones for aircraft noise measurement — certification tests
[NPL-AC-104] N86-22302
Measurement of noise from airplanes traveling at heights 3500 to 6000m
[FFA-TI-AU-2168] N86-22312
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378
NOISE REDUCTION
Beam dampers for skin vibration and noise reduction in the 747 N86-21917
Studies of acoustical fields generated by vibrating structures with applications to noise control by design N86-22300
NOISE TOLERANCE
An evaluation of study design for estimating a time-of-day noise weighting
[NASA-CR-178062] N86-22306
NONAQUEOUS ELECTROLYTES
Electrolyte for lithium-inorganic non-aqueous rechargeable cell system and rechargeable cell system including said electrolyte
[AD-D011976] N86-21647
NONDESTRUCTIVE TESTS
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Nondestructive evaluation of composites by optical time domain reflectometry N86-21604
NDE of composite materials using ultrasound: Quantitative optical detection N86-21609
A new NDE method for coated carbon-carbon composites
[AD-D011978] N86-21625
High sensitivity, one-sided X-ray inspection system
[AD-A162567] N86-21875
NONEQUILIBRIUM CONDITIONS
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
NONEQUILIBRIUM FLOW
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport
[AD-A162785] N86-21778
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258
NONEQUILIBRIUM THERMODYNAMICS
Photochemical, electrochemical and thermochemical transformation and storage of solar energy: Thermodynamic aspects N86-21991
NONGRAY GAS
Radiative interactions in transient energy transfer in gaseous systems
[NASA-CR-176644] N86-21798
NONLINEAR EQUATIONS
Asymptotic analysis of a mode 1 crack propagating steadily in a deformation theory material
[AD-A161770] N86-21689
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
Investigation of perturbation techniques for nonlinear difference equations and other related problems
[DE86-001162] N86-22224
NONLINEAR FEEDBACK
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865

NONLINEAR FILTERS
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
NONLINEAR OPTICS
Quantum electronics in the UK, a National-Survey Conference
[AD-A161623] N86-21769
Nonlinear optical spectroscopy of phonon polaritons N86-22280
NONLINEAR PROGRAMMING
Algorithms for nonlinear programming
[AD-A161746] N86-22138
NONLINEAR SYSTEMS
Limiting performance of nonlinear systems with applications to helicopter vibration control
[AD-A161457] N86-21551
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport
[AD-A162785] N86-21778
Bifurcation and stability of complex flows
[AD-A161405] N86-21799
Chaos and nonlinear dynamics of single-particle orbits in a magnetotail-like magnetic field
[AD-A161750] N86-22045
Robust adaptive control
[AD-A161349] N86-22192
Recursive estimation for nonlinear Wiener systems by online implementation of Baye's rule
[OUEL-1471/83] N86-22226
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas
[IPPJ-751] N86-22402
NONLINEARITY
Geometric and material nonlinear bending analysis of laminated composite plates and shells N86-21596
Development of research tools to study structure and evolution in the intermediate altitude regime
[AD-A162707] N86-22376
NONNEWTONIAN FLUIDS
Complexes of nitrocellulose with cupric chloride
[AD-A162519] N86-21589
An experimental study of convective heat transfer, friction, and rheology for non-Newtonian fluids: Polymer solutions, suspensions of fibers, and suspensions of particulates N86-21786
NONPARAMETRIC STATISTICS
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232
Stationary time series, quantile functions, nonparametric inference and rank transform spectrum
[AD-A161749] N86-22238
Statistical methodologies appropriate in censored survival analyses and competing risk models
[AD-A162703] N86-22245
NONRESONANCE
Passively damped joints for advanced space structures N86-21930
NORMALITY
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240
NORMALIZING (STATISTICS)
Normality scaling and eigenvalue inclusion regions — multivariable feedback systems
[OUEL-1594/85] N86-22249
NOZZLE FLOW
Prototype salvage foaming system
[AD-A161499] N86-21688
NOZZLE THRUST COEFFICIENTS
Propulsion and control propellers with thruster nozzles primarily for aircraft applications
[NASA-TM-77715] N86-21511
NOZZLE WALLS
Performance predictions for an SSME configuration with an enlarged throat
[NASA-CR-178740] N86-21579
NUCLEAR CAPTURE
Radiative neutron capture by deuterum N86-22325
NUCLEAR EXPLOSION EFFECT
Nuclear winter: Smoke generation, deposition, and removal
[AD-A161807] N86-22004
NUCLEAR EXPLOSIONS
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536
Real-time monitoring of pre-collapse phenomena using locations of seismic sources
[DE86-001649] N86-22053
Development of research tools to study structure and evolution in the intermediate altitude regime
[AD-A162707] N86-22376
NUCLEAR FISSION
Fusion and fission studies for the system S-32 + U-238 N86-22404
NUCLEAR FUEL ELEMENTS
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
NUCLEAR FUELS
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
NUCLEAR FUSION
Fusion and fission studies for the system S-32 + U-238 N86-22404
Analytic theory of the nonlinear M = 1 tearing mode
[DE86-001783] N86-22412
NUCLEAR MAGNETIC RESONANCE
Development of LC-13C NMR
[NASA-CR-176656] N86-21704
A study of orientational ordering in solid deuterium N86-22315
Raman heterodyne interference phenomena N86-22391
NUCLEAR PROPULSION
Technology for Bayton-cycle powerplants using solar and nuclear energy
[NASA-TP-2558] N86-21577
NUCLEAR RADIATION SPECTROSCOPY
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415
NUCLEAR REACTORS
Plasma flows in divertor regions of Vint-20 single-pass torsatron N86-22296
NUCLEAR RESEARCH
Japan report: Science and technology
[JPRS-JST-86-001] N86-21723
NUCLEAR RESEARCH AND TEST REACTORS
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center — research reactor
[OEFZS-4324] N86-22008
NUCLEAR STRUCTURE
Investigations of the structure and electromagnetic interaction of few-body systems
[DE86-001659] N86-22323
NUCLEATION
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
NUMBER THEORY
CWI Newsletter, no. 2, March 1984
[CWI-NEWSLETTER-2] N86-22117
Two applications of topological dynamics in combinatorial number theory N86-22118
NUMERICAL ANALYSIS
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems
[AD-A161550] N86-21730
The area-time complexity of sorting
[AD-A161562] N86-21767
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Semiempirical methods for computing turbulent flows
[NASA-TM-77996] N86-21795
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
On conservative difference schemas
[AD-A162798] N86-22221
Investigation of perturbation techniques for nonlinear difference equations and other related problems
[DE86-001162] N86-22224
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
NUMERICAL CONTROL
Computer Controller Optical Surfacing (CCOS) lap pressure control system
[AD-D011985] N86-21805
Computer controlled lead forming
[AD-D011984] N86-22183
NUMERICAL INTEGRATION
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
On stochastical integration by series of Wiener integrals
[AD-A161514] N86-22211
Numerical solution of problem on decay of high-temperature region of radiating gas with various initial internal energy distributions N86-22259

O

OBSERVATION
Prototype RECOVER system hardware and software review and future remote monitoring system philosophy. POTAS Task E.59 remote monitoring design review
[DE86-001681] N86-21574
Real-time monitoring of pre-collapse phenomena using locations of seismic sources
[DE86-001649] N86-22053
OCCULTATION
Laser propagation code study
[AD-A161370] N86-21842
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
OCEAN BOTTOM
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077
OCEAN CURRENTS
Wind driven ocean modeling and ocean model development
[AD-A161742] N86-22074
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
OCEAN MODELS
Wind driven ocean modeling and ocean model development
[AD-A161742] N86-22074
OCEAN SURFACE
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
OCEANOGRAPHY
NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054
Mariners Weather Log, Volume 29, Number 3: Summer, 1985
[PB86-108313] N86-22066
Pacific Marine Environmental Laboratory
[PB86-105525] N86-22078
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22081
OCEANS
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024
OFFSHORE PLATFORMS
Fracture control for fixed offshore structures
[AD-A162507] N86-21961
OILS
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
ONBOARD EQUIPMENT
Controlled impact demonstration on-board (interior) photographic system N86-21946
OPACITY
The X-ray spectra of bursting neutron stars: Effects of Comptonization and bound-free opacity N86-22475
OPERATING COSTS
Jet engine operating and support cost estimating relationship development
[AD-A161683] N86-21547
OPERATORS (MATHEMATICS)
Fractional calculus to represent complex modulus N86-21885
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206
Random integral representations for classes of limit distributions similar to Levy class L(O)
[AD-A161413] N86-22235
OPTICAL CORRECTION PROCEDURE
Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286

OPTICAL DATA PROCESSING
Bimodal optical computer
[AD-A161399] N86-22187
Optical acquisition, image and data compression
[AD-A161650] N86-22393
OPTICAL EQUIPMENT
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Universal wavefront sensor apparatus
[AD-D011983] N86-21830
OPTICAL HETERODYNING
Raman heterodyne interference phenomena
N86-22391
OPTICAL PATHS
Measurement of atmospheric transmission over long paths in the infrared spectral region
[AD-A161258] N86-22392
OPTICAL POLARIZATION
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396
OPTICAL PROPERTIES
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000
CZCS (Coastal Zone Color Scanner) atlas of water optical properties in the alboran sea
[AD-A162503] N86-22075
IGLAN-3 multibeam CW gas-discharge CO2 laser
N86-22266
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
Correlations between electrochemical potentials and optical charge transfer energies in ruthenium bipyridine derivatives
[AD-A161668] N86-22317
VUV optical properties of cadmium dimethyl
N86-22354
Optical acquisition, image and data compression
[AD-A161650] N86-22393
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
OPTICAL PUMPING
Comparative analysis of optically and electronically pumped broadband excimer lasers N86-22273
OPTICAL RADAR
Scintillation Detecting and Ranging (scidar/lidar) description of a gravity wave and associated turbulence
N86-22034
OPTICAL RESONATORS
Single-frequency CW lasing in injection laser based on terraced heterostructure with external dispersion cavity
N86-22274
OPTICAL WAVEGUIDES
Nondestructive evaluation of composites by optical time domain reflectometry N86-21604
OPTIMAL CONTROL
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431
OPTIMIZATION
Parameter optimization and attitude stabilization of a flexible spacecraft
[INPE-3680-PRE/830] N86-21572
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Optimum allocation in multistate systems, with applications in reliability
[AD-A161392] N86-22135
Flow optimization in dynamic and continuous networks
[AD-A162493] N86-22172
On Mini Conference on Order Restricted Inference held at Iowa University Campus on 11-13 September 1985
[AD-A162478] N86-22242
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
ORBIT CALCULATION
TV-SAT final orbit acquisition optimization strategy
[INPE-3679-PRE/829] N86-21570
ORBITS
Chaos and nonlinear dynamics of single-particle orbits in a magnetotail-like magnetic field
[AD-A161750] N86-22045
Unclassified publications of Lincoln Laboratory, volume 10
[AD-A161752] N86-22446
ORDER-DISORDER TRANSFORMATIONS
A study of orientational ordering in solid deuterium
N86-22315
ORGANIC CHEMISTRY
The 12th International Conference on Organometallic Chemistry held at Congress center Hofburg, Vienna on 8-13 September 1985. Abstracts
[AD-A161039] N86-21585
Extended abstracts, 36th International Society of Electrochemistry held at Salamanca, Spain on 23-28 September 1985
[AD-A162434] N86-21644
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
ORGANIC COMPOUNDS
An experimental evaluation of the effects of selected organic compounds on the formation of insolubles in diesel fuels
[AD-A161323] N86-21586
Charge transfer complexes of certain aromatic polyimides
[NASA-TM-77974] N86-21631
National acid precipitation assessment program emission inventory allocation factors
[PB86-104247] N86-22010
ORGANIC PHOSPHORUS COMPOUNDS
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content
[AD-A161811] N86-22083
ORGANIC SULFUR COMPOUNDS
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
ORGANIZATIONS
NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054
An organizational development handbook
[AD-A161414] N86-22438
ORGANOMETALLIC COMPOUNDS
The 12th International Conference on Organometallic Chemistry held at Congress center Hofburg, Vienna on 8-13 September 1985. Abstracts
[AD-A161039] N86-21585
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
ORIFICE FLOW
Experimental studies on cavitation inception in a submerged jet
[OUEL-1586/85] N86-21811
OSCILLATION DAMPERS
Concepts and effects of damping in isolators
N86-21891
OSCILLATIONS
Vortical flows about oscillating airfoil with surface suction N86-21502
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255
OSCILLATORS
Optically triggered bulk device gunn oscillator
[AD-D011977] N86-21780
OXIDATION
Studies on the oxidation of hexamethylbenzene 1: Oxidation of hexamethylbenzene with nitric acid
[NASA-TM-77945] N86-21628
Studies on the oxidation of hexamethylbenzene 2: Preparation of dimethylpyromellitic acid
[NASA-TM-77946] N86-21629
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide
[AD-A162694] N86-21645
Grain boundary oxidation and an analysis of the effects of pre-oxidation on subsequent fatigue life
[NASA-CR-175051] N86-21654
Characterization of reactants, reaction mechanisms and reaction products in atmospheric water droplets: Fog, cloud, dew and rain water chemistry
[PB86-107976] N86-22017
Oxidation of GaSs(110) cleaved surface N86-22345
High resolution photoemission investigation: The oxidation of W N86-22348
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
Silicon oxidation studies. Silicon orientation effects on thermal oxidation
[AD-A161633] N86-22421
A measurement of the effect of intrinsic film stress on the overall rate of thermal oxidation of silicon
[AD-A161634] N86-22422
Models for the oxidation of silicon
[AD-A161751] N86-22424
OXIDATION RESISTANCE
Experimental study of the thermal stability of materials in high temperature oxygen-containing media
N86-21633
OXIDATION-REDUCTION REACTIONS
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643
Proceedings: Protons and Membrane Reactions held at Santa Barbara, California on 28 January - 1 February 1985
[AD-A161331] N86-22082
OXIDIZERS
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
OXYGEN
Experimental studies on the reaction kinetics of 1,1-dimethylhydrazine and oxygen
[NASA-TM-77947] N86-21630
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g)
N86-22359
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
Surface analysis of space telescope material specimens
[NASA-CR-178712] N86-22460
OXYGEN ATOMS
Behavior of singlet oxygen in the oxygen-iodine transfer laser
[AD-A161390] N86-21843
OXYGEN CONSUMPTION
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
OXYGEN IONS
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643
OXYGEN MASKS
Evaluation of a passenger mask modified with a rebreather bag for protection from smoke and fumes
[AD-A162473] N86-22116
OXYGEN SPECTRA
Observations of airglow O2 (1 sigma) atmospheric band at 8645A and the rotational temperature at 23 S
N86-22030
Interpretation of the oxygen 7 soft X-ray spectrum from the Puppis-A supernova remnant N86-22481
OZONE
User's guide for the multiple airshed (MASH) model
[PB86-100146] N86-22014
EPA (Environmental Protection Agency) oxidant model: Description and evaluation plan
[PB86-103090] N86-22016

P

P-I-N JUNCTIONS
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
PACKET SWITCHING
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160
PACKET TRANSMISSION
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160
PACKETS (COMMUNICATION)
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160
PALLADIUM
The adsorption of carbon monoxide on palladium films
N86-22340
Ni, Pd and Pt overlayers on Ta(110) N86-22341

PANEL METHOD (FLUID DYNAMICS)
A direct method to calculate disturbance fields of moving bodies at subsonic speeds in compressible media
[DFVLR-FB-85-52] N86-21812
PANELS
Aircraft interior panel test criteria derived from full-scale fire tests
[AD-A161637] N86-21529
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Damping in support structures for satellite equipment reliability: RELSAT N86-21922
PARABOLOID MIRRORS
Thermal deformation of concentrators in an axisymmetric temperature field
[NASA-TM-77935] N86-21977
Carbon-fiber reinforced epoxy techniques for the X-ray Multimirror Mission (XMM) Low-Energy (LE) telescopes N86-22490
PARALLEL COMPUTERS
The area-time complexity of sorting
[AD-A161562] N86-21767
PARALLEL PROCESSING (COMPUTERS)
The area-time complexity of sorting
[AD-A161562] N86-21767
Color image processing with computer-generated spatial filters in a dispersed white-light optical system N86-22125
Parallel architectures for computer graphics displays N86-22126
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
Optimum allocation in multistate systems, with applications in reliability
[AD-A161392] N86-22135
A parallel stack processor to reduce procedure-call overhead
[AD-A162494] N86-22140
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor
[DE86-001461] N86-22143
Fast and efficient algorithms for linear programming and for the linear least squares problem
[AD-A161391] N86-22161
Parallel implementation of preconditioned conjugate gradient methods
[AD-A161988] N86-22186
An analysis and simulation of the CRAY X-MP memory system
[AD-A162769] N86-22190
An optimal repartitioning decision policy
[NASA-CR-178035] N86-22250
PARAMETER IDENTIFICATION
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549
Parameter optimization and attitude stabilization of a flexible spacecraft
[INPE-3680-PRE/830] N86-21572
Comment on: Identification in the linear errors in variable models
[FEW-159] N86-22225
Recursive estimation for nonlinear Wiener systems by online implementation of Baye's rule
[OUEL-1471/83] N86-22226
PARAMETERIZATION
M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
PARTIAL DIFFERENTIAL EQUATIONS
A study of singularities in boundary-fitted coordinate systems
[AD-A161756] N86-22214
An adaptive mesh algorithm for solving systems of time dependent partial differential equations
[AD-A161822] N86-22215
PARTICLE ACCELERATORS
LAMPF: Its origins, history, and accomplishments
[DE86-000814] N86-22383
Numerical simulation of an accelerator injector
[DE86-001572] N86-22385
PARTICLE BEAMS
Influence of electromagnetic wave and wiggler fields inhomogeneity on a free-electron laser N86-22264
PARTICLE COLLISIONS
A diffuser heat transfer and erosion code
[AD-A162436] N86-21802
PARTICLE INTERACTIONS
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
Bubble chamber studies of hadron and photon interactions
[DE86-002513] N86-22381
PARTICLE MASS
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
PARTICLE TELESCOPES
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536
PARTICULATES
Particulate models of photosynthesis
[DE86-001625] N86-22090
PASSENGERS
Proceedings of Cabin Safety Conference and Workshop held on 11-14 December 1984
[AD-A160950] N86-21527
Evaluation of a passenger mask modified with a rebreather bag for protection from smoke and fumes
[AD-A162473] N86-22116
PASSIVITY
Passive and Active Control Of Space Structures (PACOSS) N86-21931
PATENT POLICY
NASA patent abstracts bibliography: A continuing bibliography. Section 2: Indexes (supplement 28)
[NASA-SP-7039(28)] N86-22444
PATIENTS
Advanced clinical research in shock and trauma
[AD-A162730] N86-22103
PAVEMENTS
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
PELLETS
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
PENETRATION
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
PERFLUORO COMPOUNDS
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether
[NASA-TM-87260] N86-21575
Perfluoro (Imidoylamidine) diamidines
[NASA-CASE-ARC-11402-3] N86-21582
PERFORMANCE PREDICTION
Performance predictions for an SSME configuration with an enlarged throat
[NASA-CR-178740] N86-21579
PERFORMANCE TESTS
Programmable, automated transistor test system
[NASA-TP-2554] N86-21755
A Pulse Amplifier/Discriminator (PAD) for single photon counting
[AP-24] N86-21838
The Statistical Analysis Program Package (SAPP): A special data analysis program
[OEFZS-4326] N86-22248
PERIODIC VARIATIONS
Long-term X-ray variability in the Hyades cluster N86-22486
PERIPHERAL VISION
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104
PERMEABILITY
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
PERMITTIVITY
Low loss dielectrics with controllable values of specific permittivity --- microwave circuit fillers
[DRIC-T-7632] N86-21752
PERSONALITY TESTS
Personality type analysis of Air Force Institute of Technology School of Systems and Logistics graduate degree 85S class using Myers-Briggs Type-Indicator
[AD-A161053] N86-22107
PERSONNEL
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
A guide to promote the use of electronic spreadsheets among Air Force personnel
[AD-A161682] N86-22164
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
PERSPIRATION
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
PERTURBATION
A contribution to the digital compensation of periodic disturbances with frequencies in bounded intervals --- in helicopters
[DFVLR-FB-85-55] N86-21553
Studies of acoustic effects on a flow boundary layer in air
[NASA-TM-77981] N86-21792
Development of perturbations in the boundary layer
[NASA-TM-77986] N86-21793
A direct method to calculate disturbance fields of moving bodies at subsonic speeds in compressible media
[DFVLR-FB-85-52] N86-21812
PERTURBATION THEORY
Principal direction alignment, a geometric framework for the computer solution to the mu-problem --- control theory
[OUEL-1595/85] N86-22198
Necessary and sufficient stability conditions for the case of dependent additive perturbations --- control system uncertainty
[OUEL-1596/85] N86-22199
Investigation of perturbation techniques for nonlinear difference equations and other related problems
[DE86-001162] N86-22224
PETROLOGY
Apollo 15 mare units and their petrogenesis N86-22512
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513
Extraction of information from major element chemical analyses of lunar basalts N86-22514
Apollo 15 mare volcanism: Constraints and problems N86-22515
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519
Apollo 15 regolith breccias and soils: Comparative petrology and chemistry N86-22524
PH FACTOR
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
PHARMACOLOGY
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099
PHASE COHERENCE
Optical acquisition, image and data compression
[AD-A161650] N86-22393
PHASE DETECTORS
Low-noise phase/frequency detector
[AD-A161394] N86-21821
PHASE DIAGRAMS
The use of quantitative databases in Aladin, an alloy design system
[AD-A162555] N86-22176
PHASE SHIFT
All-fiber-optic gyroscope with extended linear dynamic range N86-22389
PHASE SHIFT KEYING
SAW (Surface Acoustic Wave) transition detector for PSK (Phase Shift Keying) signals
[AD-D011974] N86-21740
PHASE TRANSFORMATIONS
Development of an elevated temperature aluminum alloy containing Al3X-type dispersed phases N86-21650
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
SAW (Surface Acoustic Wave) transition detector for PSK (Phase Shift Keying) signals
[AD-D011974] N86-21740
PHASED ARRAYS
Adaptive antenna nulling performance in a dispersive propagation medium
[AD-A162708] N86-21739
PHONEMES
Attention within auditory word perception
[AD-A162550] N86-22111
PHONONS
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport
[AD-A162785] N86-21778

PHOSPHATES
Determination of Tri-n-Butyl Phosphate (TBP) in the TBP-mVarsol-HNO3 system using precision densimetry [DE86-001607] N86-21832
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257
PHOTOCHEMICAL REACTIONS
A study of the mechanism of population of high lying rotational states in hydrogen halides [AD-A161460] N86-21588
Photochemical, electrochemical and thermochemical transformation and storage of solar energy: Thermodynamic aspects N86-21991
National acid precipitation assessment program emission inventory allocation factors [PB86-104247] N86-22010
Analysis of nitric oxide fluorescence bands from high latitude rocket observations of the thermospheric dayglow N86-22018
PHOTODIODES
An intensified photodiode array applied to one-dimensional auroral imaging N86-22040
PHOTODISSOCIATION
A study of the mechanism of population of high lying rotational states in hydrogen halides [AD-A161460] N86-21588
Photodissociation of vinyl cyanide N86-22355
PHOTOELECTRIC EMISSION
Surface states on simple metal surfaces N86-22328
Angle resolved photoemission studies of electronic structure N86-22329
Angle resolved photoemission and band structure of Cu3Au N86-22335
Photon energy dependent branching ratios of the inner valence satellites in the photoemission of solid ethylene N86-22336
Photon desorption studies of synchrotron materials N86-22339
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344
Surface sensitive photoemission EXAFS: A new structural tool N86-22364
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl N86-22366
Resonance valence-band photoemission and h Nu dependent 3p photoemission of MnF2 N86-22368
Resonant photoemission studies of f-electron systems performed on station U14 N86-22369
PHOTOELECTROCHEMISTRY
Photochemical, electrochemical and thermochemical transformation and storage of solar energy: Thermodynamic aspects N86-21991
Critical view of photochemical and photoelectrochemical methods for hydrogen production — solar energy N86-21992
PHOTOELECTRON SPECTROSCOPY
Relative intensity-energy calibration of X-ray photoelectron spectrometers: Instructions for the use of reference materials SCAA83 [NPL-DMA(A)-97] N86-21813
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios [DE86-000789] N86-21834
Angle resolved photoemission studies of electronic structure N86-22329
High resolution photoemission investigation: The oxidation of W N86-22348
UV-VUV circular dichroism spectrometer N86-22352
Photoelectron spectroscopy of autoionizing Rydburg states in small molecules N86-22362
PHOTOELECTRONS
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios [DE86-000789] N86-21834
PHOTOGRAPHIC RECORDING
Development of shearographic imaging system [AD-A161819] N86-21826
PHOTOGRAPHY
Automated instrument for qualitative analysis of photographically recorded spectra [DE86-001621] N86-21833
High sensitivity, one-sided X-ray inspection system [AD-A162567] N86-21875
Selection of the Apollo 15 landing site N86-22530
PHOTOIONIZATION
Enhancing efficiency of atom ionization by pulsed periodic lasers N86-22285
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source [AD-A162401] N86-22320
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g) N86-22359
Measurement of the dissociation energies of gas phase neutral dimers by a photoionization technique N86-22360
PHOTOLITHOGRAPHY
X-ray lithography: Beamline U6 N86-22332
PHOTOLUMINESCENCE
Excited-state properties of semiconductor electrodes and their application to optical energy conversion [AD-A162774] N86-22432
PHOTOLYSIS
Critical view of photochemical and photoelectrochemical methods for hydrogen production — solar energy N86-21992
PHOTOMETERS
Contribution to the photometric determination of small amounts of boron trioxide in glasses [NASA-TM-77955] N86-21677
PHOTOMULTIPLIER TUBES
A Pulse Amplifier/Discriminator (PAD) for single photon counting [AP-24] N86-21838
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry [AD-A162415] N86-22406
PHOTON ABSORPTIOMETRY
Bolometers as spectrometers for X-ray astronomy N86-22496
PHOTON BEAMS
Undulator based beamline studies on U5 N86-22331
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g) N86-22359
Photon stimulted desoprtion of ions from polymer surfaces N86-22367
PHOTON-ELECTRON INTERACTION
Studies of e(+)e(-) interactions [DE86-001656] N86-22388
PHOTONS
A Pulse Amplifier/Discriminator (PAD) for single photon counting [AP-24] N86-21838
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
Observations of auroral and airglow spectra using a grating spectrometer with an imaging photon detector N86-22041
Nonlinear optical spectroscopy of phonon polaritons N86-22280
Bubble chamber studies of hadron and photon interactions [DE86-002513] N86-22381
Computation of angle averaged cross sections in a degenerate Compton scattering medium [DE86-000806] N86-22408
PHOTONUCLEAR REACTIONS
Inelastic scattering in condensed matter with high intensity Moessbauer radiation [DE86-002461] N86-22321
Investigations of the structure and electromagnetic interaction of few-body systems [DE86-001659] N86-22323
PHOTOSPHERE
Solar photospheric and coronal abundances from solar energetic particle measurements N86-22532
PHOTOSYNTHESIS
Particulate models of photosynthesis [DE86-001625] N86-22090
PHOTOVOLTAIC CELLS
Chemical bonding technology: Direct investigation of interfacial bonds [NASA-CR-176657] N86-21584
TDK affiliate develops new solar power cell N86-21726
The aging correlation (RH + t): Relative humidity (%) + temperature (deg C) [NASA-CR-176661] N86-21980
Test data analysis for concentrating photovoltaic arrays [DE86-001623] N86-22001
PHOTOVOLTAIC CONVERSION
Development of a microprocessor controller for stand-alone photovoltaic power systems [NASA-CR-174723] N86-21979
PHTHALOCYANIN
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes [AD-A161640] N86-21641
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen [AD-A161758] N86-21643
PHYSICAL EXERCISE
Mechanisms of bioenergetic homeostasis during exercise: A general model [AD-A161678] N86-22098
Heat acclimatization developed during summer running in northeastern United States [AD-A162728] N86-22102
PHYSICAL FITNESS
Mechanisms of bioenergetic homeostasis during exercise: A general model [AD-A161678] N86-22098
PHYSIOLOGICAL RESPONSES
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants [AD-A162444] N86-22085
PHYSIOLOGY
A Markov chain approach to electrocardiogram modeling and analysis [AD-A162776] N86-22220
PICOSECOND PULSES
Generation of picosecond pulses in monopulse-pumped dye lasers N86-22271
PIEZOELECTRIC GAGES
Piezoviscous effects in nonconformal contacts lubricated hydrodynamically [NASA-TM-87141] N86-21797
PIEZOELECTRICITY
Distributed piezoelectric-polymer active vibration control of a cantilever beam N86-21924
PILOT ERROR
A multiple-regression model of pilot performance in vertical and translational flight [AD-A161364] N86-22115
PILOT PERFORMANCE
A multiple-regression model of pilot performance in vertical and translational flight [AD-A161364] N86-22115
PILOTS (PERSONNEL)
General aviation pilot and aircraft activity survey [AD-A161665] N86-21530
PIPE FLOW
The dynamics of heat transfer in a turbulent pipe flow, part 2 [OEFZS-4325-PT-2] N86-21808
PIPELINES
On the boundary treatment in spectral methods for hyperbolic systems [NASA-CR-178055] N86-22204
PIPELINING (COMPUTERS)
A new implementation of the pipeline analog-to-digital conversion technique N86-21745
PIPES (TUBES)
Thermally induced stresses and deformations in layered composite tubes N86-21598
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory [AD-A161733] N86-21958
PISTON ENGINES
Free-piston Stirling engine development [PB86-102746] N86-21872
PISTONS
A small free-piston Stirling refrigerator N86-21716
Basic principles of the Stirling cycle N86-21717
PLANAR STRUCTURES
The synthesis of force closure grasps in the plane [AD-A162635] N86-21866
PLANE STRAIN
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897
PLANE WAVES
Acta mechanica sinica (Selected articles) [AD-A162726] N86-21522
PLANETARY ATMOSPHERES
Multiple scattering and radiative transfer in planetary atmospheres N86-22035
PLANETARY CRATERS
Meteorite craters [NASA-TM-78013] N86-22507
PLANETARY WAVES
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985 [AD-A162506] N86-22076
PLANNING
Risk and the right model [AD-A161757] N86-22440
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987 [AD-A162792] N86-22443
PLASMA CHEMISTRY
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts [AD-A161658] N86-21844

PLASMA CONTROL
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560
Plasma flows in divertor regions of Vint-20 single-pass torsatron N86-22296
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411
PLASMA DENSITY
Dynamical plasmapause positions during the July 29-31/1977 storm period: A comparison of observations and time dependent model calculations
[AERONOMICA-ACTA-A-299-1985] N86-22020
PLASMA DIAGNOSTICS
Infrared diagnosis using liquid crystal detectors
[NASA-TM-77999] N86-21815
Slow combustion of laser plasma and optical charges N86-22290
Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
PLASMA DRIFT
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
PLASMA DYNAMICS
Chaos and nonlinear dynamics of single-particle orbits in a magnetotail-like magnetic field
[AD-A161750] N86-22045
PLASMA EQUILIBRIUM
A solvable model for localized adsorption in a Coulomb system
[AD-A162697] N86-21776
PLASMA ETCHING
Investigations of the etching chemistry of electronic materials N86-22347
PLASMA HEATING
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
Plasma production with rotating ion cyclotron wave excited by Nagoya Type-3 antennas in RFC-XX
[IPPJ-752] N86-22403
PLASMA JETS
Shockwave propagation in low-temperature carbon plasma N86-22260
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318
PLASMA OSCILLATIONS
Relativistic effects during Compton interaction of strong electromagnetic radiation and optically thin layer of cold plasma N86-22295
PLASMA PHYSICS
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411
Population inversions of quantum levels in space and time-dependent fast recombining plasmas. Theory of the recombination laser
[DFVLR-FB-85-47] N86-22414
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531
PLASMA RADIATION
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406
PLASMA SHEATHS
Ionospheric effects to antenna impedance
[NASA-TM-77956] N86-21727
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
PLASMA SPRAYING
A new chromium carbide-based tribological coating for use to 900 deg C with particular reference to the Stirling engine
[NASA-TM-87274] N86-21682
Characterization of plasma-sprayed ferrite coatings N86-21854
PLASMA WAVES
Shockwave propagation in low-temperature carbon plasma N86-22260
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas
[IPPJ-751] N86-22402
PLASMA-ELECTROMAGNETIC INTERACTION
Plasmoid motion across a tangential discontinuity (with application to the magnetopause)
[AERONOMICA-ACTA-A-297-1985] N86-22019
Plasma processes in the excitation of Herbig-Haro objects
[TRITA-EPP-84-09] N86-22413
PLASMAPAUSE
Dynamical plasmapause positions during the July 29-31/1977 storm period: A comparison of observations and time dependent model calculations
[AERONOMICA-ACTA-A-299-1985] N86-22020
PLASMAS (PHYSICS)
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
Modulation of IR lasers by semiconducting plasma N86-22256
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406
Analytical applications of ICP-FTS
[DE86-000819] N86-22409
PLASTIC DEFORMATION
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
Effect of boron on tensile properties of B2 BeAl
[NASA-CR-175074] N86-21656
Shock-compression processes in inorganic powders
[DE86-002920] N86-21698
Plastic deformation on the crack line in an elastic perfectly-plastic material N86-21881
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
PLASTIC PROPERTIES
Two-dimensional strain cycling in plasticity
[AD-A161668] N86-21665
Evalution of low cycle fatigue strength of welded joints at elevated temperature: Applicability of methods of evaluation and plastic restraint
[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877
A finite element analysis of a class of problems in elasto-plasticity with hidden variables
[AD-A161642] N86-21957
PLASTICS
Thermosetting arylether compounds and their synthesis
[AD-D012025] N86-21676
Microcellular foams via phase separation
[DE86-000784] N86-21699
PLATES (STRUCTURAL MEMBERS)
Design of notched plates under compression N86-21594
Geometric and material nonlinear bending analysis of laminated composite plates and shells N86-21596
Modified finite strip method with spline functions N86-21878
Equivalent plate analysis of aircraft wing box structures with general planform geometry
[NASA-TM-87697] N86-21954
PLATES (TECTONICS)
Constraints on lithospheric structure from satellite potential field data: Africa and Asia. Analysis and interpretation of MAGSAT anomalies over North Africa
[NASA-CR-176611] N86-21968
PLATING
The electroplating of laminated chromium
[AD-A162751] N86-21671
PLATINUM
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
PLOTTING
Data reduction, management, and analysis software for CID N86-21938
PLUG NOZZLES
Aeroacoustics of contoured and solid/porous conical plug-nozzle supersonic jet flows
[NASA-CR-176645] N86-22308
PLUGS
Electrical cone connector
[AD-D011982] N86-21781
PLUMES
Investigation of solid plume simulation criteria to produce flight plume effects on multibody configuration in wind tunnel tests
[NASA-TP-2569] N86-21507
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
PLUTONIUM
Robotic sample preparation for radiochemical plutonium and americium analyses
[DE86-000801] N86-21868
PLY ORIENTATION
Response and failure analysis of a graphite-epoxy laminate containing terminating internal plies N86-21597
Effects of thickness and ply orientation on buckling of laminated plates
[NASA-TM-87691] N86-21617
PLYWOOD
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
POINT DEFECTS
Point defects and dopant diffusion in silicon N86-21743
Structure and electrical properties of strontium zipconate N86-21751
POINTING CONTROL SYSTEMS
Graphical techniques to assist in pointing and control studies of orbiting spacecraft
[NASA-TP-2575] N86-21559
POINTS (MATHEMATICS)
Shortest paths in Euclidean space with polyhedral obstacles
[AD-A161599] N86-22212
POISSON DENSITY FUNCTIONS
Spectral imaging with a CID camera
[AD-A161608] N86-21824
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240
POISSON EQUATION
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
POISSON RATIO
Finite element analysis of two cylindrical expansion problems involving near incompressible material behaviour
[OUEL-1580/85] N86-22227
POLAR CAPS
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
POLAR REGIONS
Initial simulations of the high latitude thermosphere and ionosphere with a coupled three dimensional model N86-22039
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
POLARIMETRY
X-ray polarimetry on XMM — spaceborne X ray astronomy N86-22500
POLARITONS
Nonlinear optical spectroscopy of phonon polaritons N86-22280
POLARIZATION
Spectral imaging with a CID camera
[AD-A161608] N86-21824
POLICIES
A protection model for distributed data base management systems N86-22128
POLISHING
Method of chemically polishing quartz crystal blanks
[AD-D011975] N86-21722
POLLUTION CONTROL
Characterization of emission rates from indoor combustion sources
[PB86-103900] N86-21874
POLYCRYSTALS
Void initiation preceding ductile fracture in polycrystalline titanium
[AD-A161821] N86-21668
Quasi-containerless glass formation method and apparatus
[NASA-CASE-MFS-28090-1] N86-21684
POLYETHYLENES
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425
POLYGONS
POLYGON: An interactive program for constructing and editing the geometries of polygons using a color graphics terminal
[DE86-001419] N86-22185
POLYHEDRONS
Combining computation with geometry N86-22145
Implicit B-differentiability in generalized equations
[AD-A160980] N86-22205

POLYIMIDES
Electrical photosemiconducting and paramagnetic properties of polypyromellitimides
[NASA-TM-77975] N86-21627
Charge transfer complexes of certain aromatic polyimides
[NASA-TM-77974] N86-21631
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N86-21685
POLYMER CHEMISTRY
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692
POLYMER MATRIX COMPOSITES
Vibration Damping 1984 Workshop Proceedings
[AD-A152547] N86-21883
Improved extensional modulus measurements for polymers and metal matrix composites N86-21896
Improvement of damping in fiber reinforced polymer composites N86-21898
Polyimide and the polymer-metal interaction N86-22346
POLYMERIC FILMS
Polyimide and the polymer-metal interaction N86-22346
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425
POLYMERIZATION
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-2] N86-21675
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
POLYMERS
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
POLYNOMIALS
Flow optimization in dynamic and continuous networks
[AD-A162493] N86-22172
Invariance principles under a two-part mixing assumption
[AD-A162800] N86-22223
POLYSACCHARIDES
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086
POLYSTYRENE
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Sizing of polystyrene Spheres produced in microgravity
[PB86-102241] N86-21839
POLYURETHANE RESINS
Prototype salvage foaming system
[AD-A161499] N86-21688
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099
POPULATION INVERSION
Population inversions of quantum levels in space and time-dependent fast recombining plasmas. Theory of the recombination laser
[DFVLR-FB-85-47] N86-22414
POPULATION THEORY
Isotonic rules for selecting good truncated exponential populations
[AD-A162790] N86-22247
POPULATIONS
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038
POROSITY
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
POROUS MATERIALS
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
POSITION (LOCATION)
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
Proceedings: Protons and Membrane Reactions held at Santa Barbara, California on 28 January - 1 February 1985
[AD-A161331] N86-22082
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
POSITION ERRORS
Synthetic aperture multi-telescope tracker apparatus
[AD-D011981] N86-22506
POSITION SENSING
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
POTASSIUM COMPOUNDS
KNbO3 single crystal growth by the radio frequency heating Czochralski method
[NASA-TM-77944] N86-22416
POTENTIAL FIELDS
Constraints on lithospheric structure from satellite potential field data: Africa and Asia. Analysis and interpretation of MAGSAT anomalies over North Africa
[NASA-CR-176611] N86-21968
POTENTIAL FLOW
Computation of three dimensional potential flow around a finite wing with a leading-edge discontinuity at high angle of attack N86-21504
Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521
POTTING COMPOUNDS
Capsulation of moldings made from silicon ceramic material
[NASA-TM-77933] N86-21680
POWDER (PARTICLES)
The 3rd National Conference on Metallic Powder Study was held in An-Shan
[AD-A162408] N86-21689
Controlled powder morphology experiments in megabar 304 stainless steel compaction
[DE86-002416] N86-21672
Shock-compression processes in inorganic powders
[DE86-002920] N86-21698
POWDER METALLURGY
Effect of boron on tensile properties of B2 BeAl
[NASA-CR-175074] N86-21656
The 3rd National Conference on Metallic Powder Study was held in An-Shan
[AD-A162408] N86-21689
Silicon carbide sintered products and a method for their manufacturing
[NASA-TM-77932] N86-21679
POWER EFFICIENCY
Linearized traveling wave amplifier with hard limiter characteristics
[NASA-CASE-LEW-13981-2] N86-21742
High voltage K sub a -band gyrotron experiment
[AD-A161686] N86-21845
PRECIPITATION (CHEMISTRY)
A study of precipitation and segregation on an atomic scale of 11at.percentCr-lat.percentMo heat resisting steel by atom-probe and TEM (Transmission Electron Microscope)
[AD-A161590] N86-21664
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089
PRECIPITATION (METEOROLOGY)
Operating research plan. Volume 2: Inventory of research under the National Acid Precipitation Assessment Program
[DE86-001593] N86-22007
Large scale precipitation variations over South America during the 1982-83 ENSO EVENT
[INPE-3676-PRE/827] N86-22059
WXR: Weather wire reformatting package (version 3.00) revised
[PB85-100815] N86-22069
Monthly and Seasonal Weather Outlook for Mid-September to Mid-October 1985, Volume 39, Number 18: September 14, 1985
[PB86-104684] N86-22071
Monthly and Seasonal Weather Outlook for September 1985, Volume 39, Number 17: August 30, 1985
[PB86-101672] N86-22072
PRECIPITATION HARDENING
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21663
PRECISION
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
PREDICTION ANALYSIS TECHNIQUES
Theory of wing rock
[NASA-CR-176640] N86-21520
Viscoelastic behavior and life-time predictions N86-21602
Estimation of the high temperature low cycle fatigue strength of welded joints. 1: Proposal of fundamental estimation methods
[BLL-RISLEY-TR-5236-(9091.9F)] N86-21876
Evalution of low cycle fatigue strength of welded joints at elevated temperature: Applicability of methods of evaluation and plastic restraint
[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877
Prediction of stochastic processes using self-tuning principles
[OUEL-1597/85] N86-22200
On prediction of harmonizable stable processes
[AD-A161412] N86-22210
An evaluation of study design for estimating a time-of-day noise weighting
[NASA-CR-178062] N86-22306
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
PREDICTIONS
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115
PREPARATION
Robotic sample preparation for radiochemical plutonium and americium analyses
[DE86-000801] N86-21868
PREPREGS
Thermoplastic matrix composite processing model
[NASA-CR-176639] N86-21619
PRESSURE
Piezoviscous effects in nonconformal contacts lubricated hydrodynamically
[NASA-TM-87141] N86-21797
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048
PRESSURE DEPENDENCE
Spontaneous ignition delay characteristics of hydrocarbon fuel-air mixtures
[NASA-CR-175064] N86-21545
PRESSURE GRADIENTS
Computer Controller Optical Surfacing (CCOS) lap pressure control system
[AD-D011985] N86-21805
PRESSURE REGULATORS
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430
PRESSURE VESSELS
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
PRINTED CIRCUITS
Computer controlled lead forming
[AD-D011984] N86-22183
PRINTERS
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
PRINTING
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
PRISMS
Radiation focusing by prism raster N86-22288
PROBABILITY DISTRIBUTION FUNCTIONS
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
The reduction of perturbed markov generators: An algorithm exposing the role of transient states
[AD-A162773] N86-22219
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Random integral representations for classes of limit distributions similar to Levy class L(O)
[AD-A161413] N86-22235
Investigations on statistics of terrain height
[AD-A162517] N86-22243
PROBABILITY THEORY
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading
[AD-A162495] N86-21735

Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765
Spatial classification of urban landscapes from landcovcer probaabilities derived through remote sensing N86-21967
Mathematical libraries in Ada N86-22156
Fault diversity in software reliability
[AD-A162757] N86-22182
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239

PROBLEM SOLVING
Modified finite strip method with spline functions N86-21878
Set theory and topology N86-22123
A study of singularities in boundary-fitted coordinate systems
[AD-A161756] N86-22214

PROCEDURES
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236

PROCESS CONTROL (INDUSTRY)
Microcellular foams via phase separation
[DE86-000784] N86-21699

PROCESS HEAT
Process heat applications --- solar heating N86-21990

PRODUCT DEVELOPMENT
The evolution of the cruise missile
[AD-A162646] N86-21538

PRODUCTION
Initial and qualification operational test and evaluation in the acquisition of non-major communication systems
[AD-A161729] N86-22439

PRODUCTION COSTS
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163

PRODUCTION ENGINEERING
Characterization of vesicle and microemulsion microstructures
[AD-A161459] N86-21639

PRODUCTIVITY
Maintenance planning for the 1990's (initial planning)
[PB86-106010] N86-22065

PROGRAM VERIFICATION (COMPUTERS)
Fault diversity in software reliability
[AD-A162757] N86-22182

PROGRAMMED INSTRUCTION
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169

PROJECT PLANNING
Japanese Technology Evaluation Program (JTECH): Biotechnology Panel
[PB86-109386] N86-22092
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169
NASA's long range plans
[GPO-55-035] N86-22435

PROJECTILES
Viscous fluid motion in a spinning and nutating cylinder
[AD-A162686] N86-21804

PROPAGATION VELOCITY
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

PROPELLER BLADES
Vortex conception of rotor and mutual effect of screw/propellers
[NASA-TM-77979] N86-21510

PROPELLERS
Propulsion and control propellers with thruster nozzles primarily for aircraft applications
[NASA-TM-77715] N86-21511
An analysis for the sound field produced by rigid wide cord dual rotation propellers of high solidarity in compressible flow
[NASA-TM-87178] N86-21517
Measurement of noise from airplanes traveling at heights 3500 to 6000m
[FFA-TI-AU-2168] N86-22312

PROPORTION
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232

PROPORTIONAL COUNTERS
A multiwire proportional counter for low energy X-ray imaging --- X ray astronomy N86-22499
The Penning gas imager in a space application --- X ray astronomy N86-22503

PROPULSION SYSTEM CONFIGURATIONS
Propulsion and control propellers with thruster nozzles primarily for aircraft applications
[NASA-TM-77715] N86-21511
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories)
[AD-A161664] N86-21537
Performance predictions for an SSME configuration with an enlarged throat
[NASA-CR-178740] N86-21579

PROTECTIVE CLOTHING
Evaluation of a passenger mask modified with a rebreather bag for protection from smoke and fumes
[AD-A162473] N86-22116

PROTEIN METABOLISM
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content
[AD-A161811] N86-22083

PROTEINS
Bimane derivatives as fluorescent probes for biological macromolecules
[AD-A162725] N86-22088
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

PROTON-PROTON REACTIONS
Measurements of proton-proton and proton-antiproton elastic scattering at the European Center for Nuclear Research Intersecting Storage Rings N86-22324

PROTOTYPES
Prototype salvage foaming system
[AD-A161499] N86-21688

PSYCHOLOGY
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820

PSYCHOMETRICS
Personality type analysis of Air Force Institute of Technology School of Systems and Logistics graduate degree 85S class using Myers-Briggs Type-Indicator
[AD-A161053] N86-22107

PUBLIC HEALTH
Characterization of emission rates from indoor combustion sources
[PB86-103900] N86-21874

PULSARS
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536

PULSE GENERATORS
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949

PULSE MODULATION
Radar-clutter simulator
[AD-D011992] N86-21741

PULSED LASERS
Repetitively pulsed Q-switched chemical oxygen-iodine laser
[AD-D011989] N86-21848
Effect of pulse dependent discharge on relaxing gas flow N86-22265
Investigation of electroionization pulsed carbon dioxide isotope output characteristics N86-22267
Enhancing efficiency of atom ionization by pulsed periodic lasers N86-22285

PULSED RADIATION
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307

PULSES
Digital filtering and acceleration pulse interpretation N86-21941
Opportunities in pulse combustion
[DE86-001436] N86-22003
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052

PURITY
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Quasi-containerless glass formation method and apparatus
[NASA-CASE-MFS-28090-1] N86-21684

PYLONS
Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514

PYRIDINES
Correlations between electrochemical potentials and optical charge transfer energies in ruthenium bipyridine derivatives
[AD-A161668] N86-22317

PYROLYSIS
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air N86-21632

PYROTECHNICS
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046

Q

Q SWITCHED LASERS
Repetitively pulsed Q-switched chemical oxygen-iodine laser
[AD-D011989] N86-21848

QUADRATIC PROGRAMMING
Algorithms for nonlinear programming
[AD-A161746] N86-22138

QUALIFICATIONS
General aviation pilot and aircraft activity survey
[AD-A161665] N86-21530
Personality type analysis of Air Force Institute of Technology School of Systems and Logistics graduate degree 85S class using Myers-Briggs Type-Indicator
[AD-A161053] N86-22107

QUALITATIVE ANALYSIS
Automated instrument for qualitative analysis of photographically recorded spectra
[DE86-001621] N86-21833

QUALITY CONTROL
Handbook for SRM (Standard Reference Materials) users
[PB86-110897] N86-21649

QUANTILES
Stationary time series, quantile functions, nonparametric inference and rank transform spectrum
[AD-A161749] N86-22238

QUANTITATIVE ANALYSIS
Quantitative methods for the chemical analysis of sealing glasses
[DE86-001662] N86-21702

QUANTUM CHEMISTRY
Average collisional vibrational energy transfer quantities. The exponential model
[AD-A161814] N86-22319

QUANTUM ELECTRONICS
Electrically excited phenomena in gas-phase devices
[AD-A161527] N86-21764
Quantum electronics in the UK, a National-Survey Conference
[AD-A161623] N86-21769
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299

QUANTUM THEORY
Quantum electronics in the UK, a National-Survey Conference
[AD-A161623] N86-21769

QUARTZ CRYSTALS
Method of chemically polishing quartz crystal blanks
[AD-D011975] N86-21722

QUASARS
A relativistic rotating massive object with saturation of magnetic monopoles --- galactic nuclei, quasars N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object --- galactic nuclei, quasars N86-22479

QUENCHING (ATOMIC PHYSICS)
Spectroscopic, kinetic, and dynamic experiments on atmospheric species
[AD-A162691] N86-22050

QUEUEING THEORY
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236

R

RABBITS
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

RADAR
Radar-clutter simulator
[AD-D011992] N86-21741
High frequency radar studies of the very high latitude ionosphere
[AD-A162754] N86-22051

RADAR ECHOES
Reliability of the bow echo as an important severe weather signature. Observation of bow echoes with the Marseilles radar system
[PB86-102340] N86-22070

RADAR EQUIPMENT
Reliability of the bow echo as an important severe weather signature. Observation of bow echoes with the Marseilles radar system
[PB86-102340] N86-22070

RADAR GEOLOGY
Desert studies: A global view
[AD-A161453] N86-21971

RADAR IMAGERY
An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029

RADAR MEASUREMENT
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052

RADAR NETWORKS
Desert studies: A global view
[AD-A161453] N86-21971

RADAR SCATTERING
Solar flare ionization in the mesosphere observed by coherent-scatter radar
[NASA-CR-176649] N86-22534

RADAR SIGNATURES
Reliability of the bow echo as an important severe weather signature. Observation of bow echoes with the Marseilles radar system
[PB86-102340] N86-22070
Hardware test program for evaluation of baseline range/range rate sensor concept
[NASA-CR-178710] N86-22129

RADAR TARGETS
Hardware test program for evaluation of baseline range/range rate sensor concept
[NASA-CR-178710] N86-22129

RADAR TRACKING
Hardware test program for evaluation of baseline range/range rate sensor concept
[NASA-CR-178710] N86-22129

RADIANCE
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318

RADIANT HEATING
High frequency-heated air turbojet
[NASA-TM-77710] N86-21543

RADIATION COUNTERS
A Pulse Amplifier/Discriminator (PAD) for single photon counting
[AP-24] N86-21838
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
Observations of auroral and airglow spectra using a grating spectrometer with an imaging photon detector N86-22041

RADIATION DAMAGE
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415

RADIATION DETECTORS
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536

RADIATION DOSAGE
Chemistry of MOS-LSI radiation hardening
[NASA-CR-176651] N86-21636
The measuring assembly for a primary standard absorbed dose calorimeter — high energy particle beams
[NPL-RS(EXT)-74] N86-21814

RADIATION EFFECTS
METEOSAT operational programme: Radiometer imaging electronics radiation analysis
[MTO-51F00-031] N86-21754
Fabricate, calibrate and test a dosimeter for integration into the CRRES (Combined Release and Radiation Effects Satellite)
[AD-A161695] N86-21825
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255

RADIATION HARDENING
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
Chemistry of MOS-LSI radiation hardening
[NASA-CR-176651] N86-21636

RADIATION MEASUREMENT
Robotic sample preparation for radiochemical plutonium and americium analyses
[DE86-000801] N86-21868
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center — research reactor
[OEFZS-4324] N86-22008

RADIATION PROTECTION
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084

RADIATION TRANSPORT
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410

RADIATIVE TRANSFER
Radiative interactions in transient energy transfer in gaseous systems
[NASA-CR-176644] N86-21798
Comparative accuracy of the Albedo, transmission and absorption for selected radiative transfer approximations
[NASA-RP-1160] N86-22022
Multiple scattering and radiative transfer in planetary atmospheres N86-22035

RADICALS
Applications of tunable VUV radiation N86-22350

RADIO BEACONS
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945

RADIO BURSTS
X-ray microbursts and VLF chorus
[AD-A162531] N86-22049

RADIO DIRECTION FINDERS
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945

RADIO EQUIPMENT
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160

RADIO FREQUENCIES
Linearized traveling wave amplifier with hard limiter characteristics
[NASA-CASE-LEW-13981-2] N86-21742
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377

RADIO FREQUENCY DISCHARGE
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844

RADIO FREQUENCY HEATING
Plasma production with rotating ion cyclotron wave excited by Nagoya Type-3 antennas in RFC-XX
[IPPJ-752] N86-22403
KNbO3 single crystal growth by the radio frequency heating Czochralski method
[NASA-TM-77944] N86-22416

RADIO FREQUENCY INTERFERENCE
Adaptive antenna nulling performance in a dispersive propagation medium
[AD-A162708] N86-21739

RADIO SPECTROSCOPY
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828

RADIOACTIVE DECAY
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046

RADIOACTIVE ISOTOPES
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261

RADIOACTIVITY
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center — research reactor
[OEFZS-4324] N86-22008
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410

RADIOIMMUNOASSAY
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

RAIN
Periodicities in the All India Rainfall series and in the drought and flood area indices
[INPE-3717-PRE/853] N86-22057

RAMAN SPECTRA
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses
[NASA-TM-77903] N86-21841
Nonlinear optical spectroscopy of phonon polaritons N86-22280
Raman heterodyne interference phenomena N86-22391

RAMAN SPECTROSCOPY
Nonlinear optical spectroscopy of phonon polaritons N86-22280
Diagnosis of populations and relaxation processes of vibrational and rotational states of moleucles in gases by coherent anti-Stokes scattering spectroscopy N86-22281

RAMJET ENGINES
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580

RANDOM NUMBERS
The RANDOM computer program: A linear congruential random number generator
[NASA-CR-176664] N86-22152

RANDOM VARIABLES
Stochastic analysis of drought phenomena
[AD-A160947] N86-22060
On prediction of harmonizable stable processes
[AD-A161412] N86-22210
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232

RANGE (EXTREMES)
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240

RANGE AND RANGE RATE TRACKING
Hardware test program for evaluation of baseline range/range rate sensor concept
[NASA-CR-178710] N86-22129

RAPID QUENCHING (METALLURGY)
Undercooled and rapidly quenched Ni-Mo alloys
[NASA-TM-87257] N86-21659

RARE EARTH ALLOYS
Rapidly solidified alloys of iron-rare earth boron for permanent magnets N86-21652

RARE GASES
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities
[NAL-TR-866T] N86-22314

RATES (PER TIME)
Concepts, problems and opportunities for use of annihilation energy: An annotated briefing on near-term RDT/E to assess feasibility
[AD-A161719] N86-22434

RAYLEIGH WAVES
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310

REACTION KINETICS
Experimental studies on the reaction kinetics of 1,1-dimethylhydrazine and oxygen
[NASA-TM-77947] N86-21630
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide
[AD-A162694] N86-21645
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711

Behavior of singlet oxygen in the oxygen-iodine transfer laser
[AD-A161390] N86-21843
Silicon oxidation studies. Silicon orientation effects on thermal oxidation
[AD-A161633] N86-22421
A measurement of the effect of intrinsic film stress on the overall rate of thermal oxidation of silicon
[AD-A161634] N86-22422

REACTION TIME
The effects of color-coding in geosit displays. 1: Color as a redundant code
[AD-A161107] N86-22108

REACTOR TECHNOLOGY
Influence of damage on mechanical performance of woven laminates at low temperature N86-21606
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411

READERS
A methodology for applying bar code technology to Aircraft Maintenance Unit support sections
[AD-A161783] N86-22441

READING
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820

REAL TIME OPERATION
Real-time monitoring of pre-collapse phenomena using locations of seismic sources
[DE86-001649] N86-22053
ANIMAC: A multiprocessor architecture for real time computer animation N86-22149
Robust adaptive control
[AD-A161349] N86-22192

RECHARGING
Electrolyte for lithium-inorganic non-aqueous rechargeable cell system and rechargeable cell system including said electrolyte
[AD-D011976] N86-21647

RECOMBINATION COEFFICIENT
Atom recombination as a source of airglow N86-22036

RECOMBINATION REACTIONS
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Population inversions of quantum levels in space and time-dependent fast recombining plasmas. Theory of the recombination laser
[DFVLR-FB-85-47] N86-22414
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane
[AD-A162548] N86-22426

RECREATION
Vertically operating flight vehicle for drilling and agricultural use
[NASA-TM-77713] N86-21535

RECTANGULAR PLANFORMS
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623

RECTANGULAR PLATES
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623

RECURSIVE FUNCTIONS
Recursive estimation for nonlinear Wiener systems by online implementation of Baye's rule
[OUEL-1471/83] N86-22226

REDUCED GRAVITY
NBS (National Bureau of Standards): Materials measurements
[NASA-CR-176646] N86-21648

REDUCTION (CHEMISTRY)
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643

REFERENCE ATMOSPHERES
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048

REFLECTANCE
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000
Reflectance measurements of aluminum coatings at 200 - 500 nm N86-22351

REFLEXES
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101

REFRACTIVITY
Determination of optical inhomogeneity of cylindrical bodies by light beam deflection N86-22284

REFRACTORIES
Shock-compression processes in inorganic powders
[DE86-002920] N86-21698
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379

REFRACTORY MATERIALS
Dual material exhaust nozzle flap
[AD-D011998] N86-21548
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
Thermo-mechanical and thermal behavior of high-temperature structural materials
[AD-A161741] N86-21959

REFRIGERATING
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715
Basic principles of the Stirling cycle N86-21717

REFRIGERATORS
Design and fabrication of a long-life Stirling cycle cooler for space appliction. Phases 1 and 2: Engineering model
[NASA-CR-175288] N86-21714
A small free-piston Stirling refrigerator N86-21716

REFUELING
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540

REGENERATORS
High-temperature ceramic recuperator and combustion air burner programs: Seal development
[PB86-105079] N86-21870

REGISTERS (COMPUTERS)
Reducing memory references via effective register usage
[AD-A161352] N86-21760

REGOLITH
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Regolith erosion and regolith mixing at the Apollo 15 site on the moon N86-22511
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513
Chemical components of the Apollo 15 regolith N86-22518
Samples at the Apollo 15 landing site: Types and distribution N86-22522
Apollo 15 regolith breccias and soils: Comparative petrology and chemistry N86-22524

REGRESSION ANALYSIS
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21662
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001
Periodicities in the All India Rainfall series and in the drought and flood area indices
[INPE-3717-PRE/853] N86-22057
Stochastic analysis of drought phenomena
[AD-A160947] N86-22060
Powers of tests for constant regression coefficients under several alternative models N86-22229
Bootstrapping Cox's regression model
[AD-A162443] N86-22241

REGRESSION COEFFICIENTS
Comment on: Identification in the linear errors in variable models
[FEW-159] N86-22225
Powers of tests for constant regression coefficients under several alternative models N86-22229

REINFORCED PLASTICS
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697

REINFORCEMENT (STRUCTURES)
Composite laminate free edge reinforcement concepts N86-21601

REINFORCING FIBERS
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620

RELATIVISTIC EFFECTS
Relativistic effects during Compton interaction of strong electromagnetic radiation and optically thin layer of cold plasma N86-22295

RELATIVISTIC ELECTRON BEAMS
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
Analytical methods of electrode design for a relativistic electron gun
[DE86-001584] N86-22387

RELATIVISTIC PARTICLES
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380
Numerical simulation of an accelerator injector
[DE86-001572] N86-22385
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408

RELATIVISTIC THEORY
A relativistic rotating massive object with saturation of magnetic monopoles --- galactic nuclei, quasars N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object --- galactic nuclei, quasars N86-22479

RELAXATION (MECHANICS)
Experimental measurement of material damping for space structures N86-21887

RELIABILITY
Reliability of the bow echo as an important severe weather signature. Observation of bow echoes with the Marseilles radar system
[PB86-102340] N86-22070

RELIABILITY ENGINEERING
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921

REMOTE CONTROL
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540
Prototype RECOVER system hardware and software review and future remote monitoring system philosophy. POTAS Task E.59 remote monitoring design review
[DE86-001681] N86-21574

REMOTE MANIPULATOR SYSTEM
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113

REMOTE SENSING
Norwegian aerospace activities: An overview
[NASA-TM-77711] N86-21562
Spatial classification of urban landscapes from landcovcer probaabilities derived through remote sensing N86-21967
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data
[NASA-CR-176660] N86-21970
Current celocity and hydrographic observations of the Straits of Florida: Subtropical Atlantic climate study (STACS) 1983 and 1984
[PB86-108602] N86-22079

REMOTELY PILOTED VEHICLES
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933

REMOVAL
Rubber removal specification development
[FAA/PM-85/33] N86-21555
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162528] N86-22006

REPLACING
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500

REPLICAS
Electroform replication of grazing incidence X-ray optics --- spaceborne telescopes N86-22491

REPORTS
Activities report of the aerospace industry in West Germany
[ISSN-0176-5086] N86-22450

RESEARCH
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

RESEARCH AIRCRAFT
Procedure for utilizing the lift and thrust forces of ornithopters
[NASA-TM-77682] N86-21534

RESEARCH AND DEVELOPMENT
The Army Research Institute Unit Performance Research and Development Center
[NASA-CR-176618] N86-21706
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
Exploring the utility of a staged technology assessment process, volume 2
[PB86-109410] N86-22454
RESEARCH FACILITIES
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
LAMPF: Its origins, history, and accomplishments
[DE86-000814] N86-22383
RESEARCH MANAGEMENT
The Army Research Institute Unit Performance Research and Development Center
[NASA-CR-176618] N86-21706
Magnetic systems for fusion devices
[DE86-000743] N86-22407
RESERVOIRS
Coso: Example of a complex geothermal reservoir
[AD-A162575] N86-21999
RESIDENTIAL AREAS
Free-piston Stirling engine development
[PB86-102746] N86-21872
RESIDUAL STRESS
Modifications in microstructure, deformation and fatigue behavior by ion implantation
[AD-A161688] N86-21667
RESIN MATRIX COMPOSITES
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11538-1SB] N86-21590
Chemical modification of matrix resin networks with engineering thermoplastics: Morphology and properties of poly(aryl ether sulfone) modified epoxy networks N86-21613
Analysis and experiments on interlaminar fracture toughness in resin matrix composites
[AD-A162689] N86-21622
RESISTANCE THERMOMETERS
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
RESISTOJET ENGINES
A bibliography of electrothermal thruster technology, 1984
[NASA-TM-86998] N86-21578
RESONANCE
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
RESONANT VIBRATION
Improved extensional modulus measurements for polymers and metal matrix composites N86-21896
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
Laminated damped fuselage structures N86-21916
RESONATORS
Novel methods for tuning free electron lasers to multiple wavelengths
[AD-D011986] N86-21847
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299
RESPIRATORY SYSTEM
Advanced clinical research in shock and trauma
[AD-A162730] N86-22103
REUSABLE SPACECRAFT
Manned spaceflight in the nineties: The European perspective
[NASA-TM-77697] N86-21561
REUSE
Ada reusability guidelines
[AD-A161259] N86-22157
RHEOLOGY
An experimental study of convective heat transfer, friction, and rheology for non-Newtonian fluids: Polymer solutions, suspensions of fibers, and suspensions of particulates N86-21786
RHYTHM (BIOLOGY)
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
RIGID STRUCTURES
Simulation of motions of satellites carrying a deployable flexible linkage N86-21568
Sizing of discrete viscous dampers on a flexible body in the presence of a fixed controller N86-21926
RIGIDITY
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
RING STRUCTURES
Apparatus for transmitting data from high speed rotors
[AD-D011991] N86-21831
RISK
Statistical methodologies appropriate in censored survival analyses and competing risk models
[AD-A162703] N86-22245
Risk and the right model
[AD-A161757] N86-22440
RITZ AVERAGING METHOD
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
RIVERS
Green River air quality model development. VALMET: A valley air pollution model
[PB86-104106] N86-22013
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073
ROBOTICS
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865
Robotic sample preparation for radiochemical plutonium and americium analyses
[DE86-000801] N86-21868
The LATDYN user's manual
[NASA-TM-87635] N86-21953
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
Complexity of the generalized mover's problem
[AD-A161378] N86-22209
ROBOTS
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
Planning by search through simulations
[AD-A162470] N86-21864
The synthesis of force closure grasps in the plane
[AD-A162635] N86-21866
Robotic sample preparation for radiochemical plutonium and americium analyses
[DE86-000801] N86-21868
ROBUSTNESS (MATHEMATICS)
Robustness of multivariable feedback systems: Analysis and optimal design
[OUEL-1601/85] N86-22201
Powers of tests for constant regression coefficients under several alternative models N86-22229
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232
ROCKET ENGINE CASES
A fracture mechanics analysis of impact damage in a thick composite laminate N86-21607
ROCKET ENGINES
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
ROCKET EXHAUST
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
ROCKET SOUNDING
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
The nightglow hydroxl (8-3) band emission: A comparison of experiment and theory N86-22031
Middle infrared emission studies in the upper atmosphere by rocket techniques N86-22033
RODS
Quasi-containerless glass formation method and apparatus
[NASA-CASE-MFS-28090-1] N86-21684
ROLLING MOMENTS
Control of missile dispersion via roll rate modulation
[AD-A162542] N86-21565
ROOM TEMPERATURE
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
ROTARY WINGS
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521
ROTATING BODIES
Airborne tracking Sun photometer apparatus and system
[NASA-CASE-ARC-11622-1] N86-21982
A relativistic rotating massive object with saturation of magnetic monopoles — galactic nuclei, quasars N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object — galactic nuclei, quasars N86-22479
ROTATING ENVIRONMENTS
Vection-induced gastric dysrhythmias and motion sickness
[NASA-CR-176620] N86-22095
ROTATING MATTER
Damping applications in turbine engines N86-21888
ROTATING MIRRORS
Multispectral glancing incidence X-ray telescope
[NASA-CASE-MFS-28013-1] N86-22459
ROTATION
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
ROTOR BLADES (TURBOMACHINERY)
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
ROTORS
Vortex conception of rotor and mutual effect of screw/propellers
[NASA-TM-77979] N86-21510
Apparatus for transmitting data from high speed rotors
[AD-D011991] N86-21831
ROUTES
Flow optimization in dynamic and continuous networks
[AD-A162493] N86-22172
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
RUBBER
Rubber removal specification development
[FAA/PM-85/33] N86-21555
RUBBER COATINGS
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
RUNNING
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
RUNWAY CONDITIONS
Rubber removal specification development
[FAA/PM-85/33] N86-21555
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
RUTHENIUM
Correlations between electrochemical potentials and optical charge transfer energies in ruthenium bipyridine derivatives
[AD-A161668] N86-22317
RYDBERG SERIES
Photoelectron spectroscopy of autoionizing Rydburg states in small molecules N86-22362

S

SAFETY
Biomedical and environmental sciences at Oak Ridge National Laboratory
[DE86-001639] N86-22091
SAFETY DEVICES
Safeguards instrumentation: A computer-based catalog, second edition
[DE86-000840] N86-21835
SAFETY MANAGEMENT
Proceedings of Cabin Safety Conference and Workshop held on 11-14 December 1984
[AD-A160950] N86-21527
SAMPLING
F100 fuel sampling analysis
[AD-A161667] N86-21707
A conditional sampling module for the TSI laser Doppler anemometer counter processor
[AD-A161555] N86-21823

Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005
Bootstrapping Cox's regression model
[AD-A162443] N86-22241
Investigations on statistics of terrain height
[AD-A162517] N86-22243

SANDWICH STRUCTURES
Analysis of aluminum/aramid-epoxy hybrid laminates N86-21595
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623

SAPPHIRE
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430

SATELLITE ANTENNAS
Ionospheric effects to antenna impedance
[NASA-TM-77956] N86-21727

SATELLITE IMAGERY
METEOSAT operational programme: Radiometer imaging electronics radiation analysis
[MTO-51F00-031] N86-21754
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region
[DFVLR-FB-85-49] N86-21972

SATELLITE INSTRUMENTS
Damping in support structures for satellite equipment reliability: RELSAT N86-21922

SATELLITE TRACKING
Hardware test program for evaluation of baseline range/range rate sensor concept
[NASA-CR-178710] N86-22129

SATELLITE-BORNE INSTRUMENTS
Instrumentation for X-ray spectroscopy --- spaceborne astronomy N86-22471

SATURN RINGS
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531

SCALARS
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665

SCALING LAWS
Laser propagation code study
[AD-A161370] N86-21842
Principal direction alignment, a geometric framework for the computer solution to the mu-problem --- control theory
[OUEL-1595/85] N86-22198
Normality scaling and eigenvalue inclusion regions --- multivariable feedback systems
[OUEL-1594/85] N86-22249

SCANNERS
Scanning soft X-ray microscopy on the U15 beam line N86-22372

SCANNING
Determination of the modulation transfer function of line scanned infrared imaging systems
[AD-A161521] N86-21822

SCATTERING
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Investigations of the structure and electromagnetic interaction of few-body systems
[DE86-001659] N86-22323

SCATTERING CROSS SECTIONS
Effects of waveguide modes on the scattering of a finite tubular cylinder
[AD-A161500] N86-21729
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408

SCATTERING FUNCTIONS
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044

SCHEDULES
NASA's long range plans
[GPO-55-035] N86-22435

SCHEDULING
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
Planning by search through simulations
[AD-A162470] N86-21864

SCHLIEREN PHOTOGRAPHY
Optical elements formed by compressed gases: Analysis and potential applications
[NASA-TP-2555] N86-22390

SCHMIDT NUMBER
Experiments on entrainment, mixing and chemical reactions in turbulent jets at large Schmidt number N86-21503

SCHOTTKY DIODES
Interface structure and electronic properties of the titanium-silicon system N86-21749

SCINTILLATION
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509

SCINTILLATION COUNTERS
Scintillation Detecting and Ranging (scidar/lidar) description of a gravity wave and associated turbulence N86-22034
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536

SEA WATER
CZCS (Coastal Zone Color Scanner) atlas of water optical properties in the alboran sea
[AD-A162503] N86-22075

SEALERS
Manufacture of high-density ceramic sinters
[NASA-TM-77925] N86-21678

SEALING
Quantitative methods for the chemical analysis of sealing glasses
[DE86-001662] N86-21702

SEAMOUNTS
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076

SEARCHING
Two new approximate solution techniques for a moving target problem when searcher motion is constrained
[AD-A162491] N86-22171

SEAT BELTS
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
Impact dynamics instrumentation N86-21948

SEATS
CID overview N86-21934
NASA experiments on the B-720 structure and seats N86-21936
Controlled impact demonstration seat/cabin restraint systems: FAA N86-21937
NASA seat experiment and occupant responses N86-21939
Structural loads preliminary results N86-21940
Preliminary floor, seat, and dummy data N86-21942

SEDIMENT TRANSPORT
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073

SEDIMENTS
Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005

SEGMENTS
Plane representations of graphs and visibility between parallel segments
[AD-A161689] N86-21770

SEISMIC ENERGY
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044

SEISMIC WAVES
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044
Ground response in alluvial basins due to seismic disturbances
[AD-A162467] N86-22047

SEISMOLOGY
Real-time monitoring of pre-collapse phenomena using locations of seismic sources
[DE86-001649] N86-22053
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077

SELECTION
Isotonic rules for selecting good truncated exponential populations
[AD-A162790] N86-22247

SELF ADAPTIVE CONTROL SYSTEMS
Tutorials on self-tuning control. Volume 1: Introduction to self-tuning and adaptive control
[OUEL-1592/85-VOL-1] N86-22196
Prediction of stochastic processes using self-tuning principles
[OUEL-1597/85] N86-22200

SELF SEALING
Self-compensating solenoid valve
[NASA-CASE-ARC-11620-1] N86-21659

SEMICONDUCTOR DEVICES
Optically triggered bulk device gunn oscillator
[AD-D011977] N86-21780
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432

SEMICONDUCTOR DIODES
Single-frequency CW lasing in injection laser based on terraced heterostructure with external dispersion cavity N86-22274

SEMICONDUCTOR JUNCTIONS
Squeezable tunnel junctions
[AD-A161537] N86-22419

SEMICONDUCTOR LASERS
Semiconductor laser source for natural gas leak detection
[PB86-102811] N86-21849

SEMICONDUCTORS (MATERIALS)
Electrical photosemiconducting and paramagnetic properties of polypyromellitimides
[NASA-TM-77975] N86-21627
Apparatus for edge etching of semiconductor wafers
[NASA-TM-77998] N86-21720
TDK affiliate develops new solar power cell N86-21726
Gallium Arsenide structures and interfaces formed by molecular beam epitaxy N86-21747
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
Project: Submicron phononics 1. 1. The problematics of phonon disturbances in d.c. Semiconductor transport
[AD-A162785] N86-21778
High band GaP 3-5 tunneling junction for silicon multijunction solar cells
[NASA-CASE-NPO-16526-1CU] N86-21981
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
Modulation of IR lasers by semiconducting plasma N86-22256
Models for the oxidation of silicon
[AD-A161751] N86-22424
Semiconductor millimeter wavelength electronics
[AD-A162566] N86-22427
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432

SENSITIVITY
Sensitivity of solid explosives: Minimum energy of a dangerous impact
[NASA-TM-88405] N86-21703
Multi-Input, Multi-Output sensitivity points tuning
[AD-A161641] N86-22193
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities
[NAL-TR-866T] N86-22314

SENSORS
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113

SEPARATED FLOW
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack
[AD-A162407] N86-21801

SEQUENCING
Sequential decoding for multiple access channels
[AD-A162630] N86-21736
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758

SERIES (MATHEMATICS)
The asymptotic behavior of an exponential-type series
[AD-A162574] N86-22394

SERVICE LIFE
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715

SET THEORY
CWI Newsletter, no. 7, June 1985
[CWI-NEWSLETTER-7] N86-22121
Set theory and topology N86-22123
CWI Newsletter, no. 6, March 1985
[CWI-NEWSLETTER-6] N86-22154
The Pythagoras tree as a Julia set N86-22155
Finding critical sets
[AD-A161368] N86-22207
On conservative difference schemas
[AD-A162798] N86-22221

The asymptotic behavior of an exponential-type series
[AD-A162574] N86-22394

SHADOWS
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531

SHAPES
Research on accustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310

SHEAR FLOW
Experimental study of shear flows and convective heat transfer characteristics of granular materials N86-21785

SHEAR LAYERS
Heat release effects in a turbulent, reacting shear layer N86-21788

SHEAR PROPERTIES
Complexes of nitrocellulose with cupric chloride
[AD-A162519] N86-21589
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Development of shearographic imaging system
[AD-A161819] N86-21826
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21894

SHEAR STRENGTH
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697

SHEAR STRESS
Boundary layer effects in nearly incompressible cracked bodies N86-21605
Shear stress concentration near the edge of a thin film deposited on a substrate N86-21880

SHEATHS
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Improvements in the weldability of a superconductor sheath material
[DE86-000748] N86-21867

SHELL THEORY
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964

SHELLS (STRUCTURAL FORMS)
Geometric and material nonlinear bending analysis of laminated composite plates and shells N86-21596

SHOCK (PHYSIOLOGY)
The role of endorphins in the pathophysiology of hemorrhagic and endotoxic shock in the subhuman primate
[AD-A162483] N86-22100
Advanced clinical research in shock and trauma
[AD-A162730] N86-22103

SHOCK ABSORBERS
NASA experiments on the B-720 structure and seats N86-21936
NASA seat experiment and occupant responses N86-21939

SHOCK LAYERS
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258

SHOCK LOADS
An eight-inch diameter, heavily confined card gap test
[AD-A161557] N86-21705
Shock fracture and recompaction of ceramics N86-21879

SHOCK TESTS
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711

SHOCK TUBES
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635

SHOCK WAVE INTERACTION
Measurement of heat-transfer coefficients in shock wave-turbulent boundary layer interaction regions with a multi-layered thin film heat transfer gauge
[NASA-TM-77958] N86-21790

SHOCK WAVE PROPAGATION
Burger's equation and shock waves propagating within liquid-gas mixtures
[AD-A161554] N86-21800
The influence of initial and boundary conditions on gaseous detonation waves
[AD-A162631] N86-21803
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
Shockwave propagation in low-temperature carbon plasma N86-22260

SHOCK WAVES
Experimental studies on the reaction kinetics of 1,1-dimethylhydrazine and oxygen
[NASA-TM-77947] N86-21630
Vibration isolation of an elevator system N86-21914

SIDESLIP
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[DFVLR-FB-85-50] N86-21541
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549

SIGNAL DETECTION
Spread spectrum acquisition and tracking
[AD-A162442] N86-21734
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779

SIGNAL DETECTORS
SAW (Surface Acoustic Wave) transition detector for PSK (Phase Shift Keying) signals
[AD-D011974] N86-21740
Apparatus for transmitting data from high speed rotors
[AD-D011991] N86-21831

SIGNAL MEASUREMENT
Synthetic aperture multi-telescope tracker apparatus
[AD-D011981] N86-22506

SIGNAL PROCESSING
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779
Elastodynamic scattering by periodic surface indentations N86-21882
Digital filtering and acceleration pulse interpretation N86-21941
CID-720 aircraft high-environment flight instrumentation system N86-21947
Bimodal optical computer
[AD-A161399] N86-22187
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Optical acquisition, image and data compression
[AD-A161650] N86-22393

SIGNAL TO NOISE RATIOS
Adaptive antenna nulling performance in a dispersive propagation medium
[AD-A162708] N86-21739
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077

SIGNAL TRANSMISSION
Apparatus for transmitting data from high speed rotors
[AD-D011991] N86-21831

SIGNATURES
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956

SIGNS AND SYMPTOMS
An algebraic syndrome decoding technique for certain convolutional codes
[AD-A162636] N86-22177

SILANES
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane
[AD-A162548] N86-22426

SILICA GEL
Transparent superinsulating materials: New aspects in solar technology — silica gel N86-21987

SILICA GLASS
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257

SILICATES
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
Apollo 15 mare volcanism: Constraints and problems N86-22515

SILICON
Capsulation of moldings made from silicon ceramic material
[NASA-TM-77933] N86-21680
Point defects and dopant diffusion in silicon N86-21743
Interface structure and electronic properties of the titanium-silicon system N86-21749
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Silicon compilation: A solution to the complexity of VLSI (Very Large-Scale Integrated) circuit design
[AD-A162564] N86-21774
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
Metal-insulator transition on the Ge(001) surface N86-22327
Investigations of the etching chemistry of electronic materials N86-22347
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
Silicon oxidation studies. Silicon orientation effects on thermal oxidation
[AD-A161633] N86-22421
Models for the oxidation of silicon
[AD-A161751] N86-22424

SILICON CARBIDES
Fatigue response of silicon carbide whisker/aluminum matrix composites N86-21591
The effects of surface finish and grain size on the strength of sintered silicon carbide
[NASA-TM-77871] N86-21616
Silicon carbide sintered products and a method for their manufacturing
[NASA-TM-77932] N86-21679
Damping in metal-matrix composites: Measurement and modeling N86-21901
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide
[AD-A161455] N86-21955

SILICON DIOXIDE
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
Models for the oxidation of silicon
[AD-A161751] N86-22424

SILICON FILMS
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430

SILICON JUNCTIONS
High band GaP 3-5 tunneling junction for silicon multijunction solar cells
[NASA-CASE-NPO-16526-1CU] N86-21981

SILICON NITRIDES
Boronnitride and siliconnitride systems
[AD-A161563] N86-21640

SILICONES
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584

SILOXANES
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N86-21685

SILVER
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
Diffusion and solubility of oxygen in silver
[NASA-TM-77936] N86-21655

SILVER ALLOYS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

SIMPLEX METHOD
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169

SIMULATION
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Radar-clutter simulator
[AD-D011992] N86-21741

A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
A simulation program with latency exploitation and node tearing
[AD-A161379] N86-21762
NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437

SINGLE CRYSTALS
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396
KNbO3 single crystal growth by the radio frequency heating Czochralski method
[NASA-TM-77944] N86-22416
Models for the oxidation of silicon
[AD-A161751] N86-22424

SINGULARITY (MATHEMATICS)
A study of singularities in boundary-fitted coordinate systems
[AD-A161756] N86-22214
Systematics of strongly self-dominant higher order differential equations based on the painleve analysis of their singularities
[AD-A162545] N86-22216

SINTERING
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
The effects of surface finish and grain size on the strength of sintered silicon carbide
[NASA-TM-77871] N86-21616
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Manufacture of high-density ceramic sinters
[NASA-TM-77925] N86-21678
Silicon carbide sintered products and a method for their manufacturing
[NASA-TM-77932] N86-21679
Removal of glass adhered to sintered ceramics in hot isostatic pressing
[NASA-TM-77930] N86-21719
Chemical preparation of high-field zinc oxide varistors
[DE86-001611] N86-21784

SITE SELECTION
Selection of the Apollo 15 landing site N86-22530

SIZE (DIMENSIONS)
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820

SKIN (ANATOMY)
Electrodermal changes corresponding to the degree of discomfort induced by motion sickness
[NAL-TR-880] N86-22096

SKIN (STRUCTURAL MEMBER)
Laminated damped fuselage structures N86-21916
Use of skin damping treatments to control airframe dynamic response for interior noise control N86-21919

SKIN FRICTION
Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514

SKIN TEMPERATURE (BIOLOGY)
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102

SLENDER BODIES
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522

SMOKE
Nuclear winter: Smoke generation, deposition, and removal
[AD-A161807] N86-22004
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
Evaluation of a passenger mask modified with a rebreather bag for protection from smoke and fumes
[AD-A162473] N86-22116

SODAR
Studies of complex-terrain flows using acoustic remote sensors
[PB86-100138] N86-22068

SODIUM
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349

SOFTWARE ENGINEERING
Prototype RECOVER system hardware and software review and future remote monitoring system philosophy. POTAS Task E.59 remote monitoring design review
[DE86-001681] N86-21574
Programmable, automated transistor test system
[NASA-TP-2554] N86-21755
Automated generation of microcontrollers
[AD-A162668] N86-21775
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
Installing a copy of the ARPA/DMA image understanding testbed at the US Army Engineer Topographic Laboratories
[AD-A158394] N86-21818
WXR: Weather wire reformatting package (version 3.00) revised
[PB85-100815] N86-22069
Software development: Science or patchwork N86-22119
Functional test generation of digital LSI/VLSI systems using machine symbolic execution technique N86-22146
A graphical debugger for concurrent Ada programs N86-22147

SOFTWARE TOOLS
Software development: Science or patchwork N86-22119

SOIL MECHANICS
A large strain finite element formulation for one dimensional membrane elements --- soil mechanics
[OUEL-1603/85] N86-22228

SOILS
Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162528] N86-22006
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519

SOLAR ACTIVITY
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

SOLAR ARRAYS
Chemical bonding technology: Direct investigation of interfacial bonds
[NASA-CR-176657] N86-21584

SOLAR ATMOSPHERE
Spectral imaging with a CID camera
[AD-A161606] N86-21824

SOLAR CELLS
TDK affiliate develops new solar power cell N86-21726
Transient heat pipe investigations for space power systems
[DE86-000813] N86-21806
High band GaP 3-5 tunneling junction for silicon multijunction solar cells
[NASA-CASE-NPO-16526-1CU] N86-21981
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001

SOLAR COLLECTORS
Solar systems with highly efficient collectors N86-21988
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001

SOLAR CORONA
Solar photospheric and coronal abundances from solar energetic particle measurements N86-22532

SOLAR ENERGY
Technology for Bayton-cycle powerplants using solar and nuclear energy
[NASA-TP-2558] N86-21577
Solar energy 85: Resources, technologies, economics --- conferences
[ESA-SP-240] N86-21983
Solar radiative energy N86-21984
Photochemical, electrochemical and thermochemical transformation and storage of solar energy: Thermodynamic aspects N86-21991
Role of hydrogen in solar energy utilization: Problems and aspects of the hydrogen issue N86-21993
Experiences with solar power N86-21994
Technology assessment of solar energy utilization N86-21995
Space applications of solar energy systems N86-21996
Solar energy: One decade of research and application, review and outlook N86-21997

SOLAR ENERGY CONVERSION
TDK affiliate develops new solar power cell N86-21726
Solar radiative energy N86-21984
The other aspect of solar energy utilization. Solar technologies export enhancement: A central European point of view N86-21985
Solar systems with highly efficient collectors N86-21988
District heating by solar energy with heat storage N86-21989
Critical view of photochemical and photoelectrochemical methods for hydrogen production --- solar energy N86-21992

SOLAR FLARES
A search for outflows from X-ray bright points in coronal holes
[NASA-CR-176647] N86-22458
Solar photospheric and coronal abundances from solar energetic particle measurements N86-22532
Solar flare ionization in the mesosphere observed by coherent-scatter radar
[NASA-CR-176649] N86-22534

SOLAR FLUX
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023
A search for outflows from X-ray bright points in coronal holes
[NASA-CR-176647] N86-22458

SOLAR GENERATORS
Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979
Experiences with solar power N86-21994

SOLAR HEATING
Passive and hybrid solar systems N86-21986
Solar systems with highly efficient collectors N86-21988
District heating by solar energy with heat storage N86-21989
Process heat applications --- solar heating N86-21990
Experiences with solar power N86-21994

SOLAR HOUSES
Passive and hybrid solar systems N86-21986
Transparent superinsulating materials: New aspects in solar technology --- silica gel N86-21987

SOLAR RADIATION
Solar radiative energy N86-21984

SOLAR SENSORS
Airborne tracking Sun photometer apparatus and system
[NASA-CASE-ARC-11622-1] N86-21982

SOLAR SPECTRA
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000

SOLAR SYSTEM
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531
SOLAR WIND
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
A computer simulation study of the microscopic structure of a typical current sheet in the solar wind
[AERONOMICA-ACTA-A-301-1985] N86-22533
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
SOLAR X-RAYS
A search for outflows from X-ray bright points in coronal holes
[NASA-CR-176647] N86-22458
SOLENOID VALVES
Self-compensating solenoid valve
[NASA-CASE-ARC-11620-1] N86-21859
SOLID PHASES
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
SOLID PROPELLANT ROCKET ENGINES
Test fixture effects in vibration tests of rocket motors
[AD-A161403] N86-21581
SOLID PROPELLANTS
Sensitivity of solid explosives: Minimum energy of a dangerous impact
[NASA-TM-88405] N86-21703
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques
[AD-A162746] N86-21710
SOLID ROCKET PROPELLANTS
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
SOLID STATE DEVICES
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
Room temperature solid state spectrometer for X-ray astronomy N86-22497
SOLID STATE LASERS
New findings on creation of powerful tunable subpicosecond solid-state lasers N86-22263
SOLIDIFICATION
Drop tube technical tasks
[NASA-CR-178741] N86-21564
Rapidly solidified alloys of iron-rare earth boron for permanent magnets N86-21652
SOLITARY WAVES
Soliton turbulence
[NASA-CR-3969] N86-22056
SOLUBILITY
Development of an elevated temperature aluminum alloy containing Al3X-type dispersed phases N86-21650
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655
SOLVOLYSIS
Neighboring group participation in solvolysis of organosulfur and related compounds
[AD-A161458] N86-21587
SOS (SEMICONDUCTORS)
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430
SOUND FIELDS
An analysis for the sound field produced by rigid wide cord dual rotation propellers of high solidarity in compressible flow
[NASA-TM-87178] N86-21517
Studies of acoustical fields generated by vibrating structures with applications to noise control by design N86-22300
SOUND GENERATORS
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
SOUND PRESSURE
Studies of acoustical fields generated by vibrating structures with applications to noise control by design N86-22300
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
SOUND WAVES
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307
Nonlinear acoustic wave propagation in atmosphere
[NASA-CR-176642] N86-22309
SOUNDING ROCKETS
Rocket experiments for spectral estimation of electron density fine structure in the auroral and equatorial ionosphere and preliminary results
[NASA-CR-176648] N86-22026
SOUTH AMERICA
Large scale precipitation variations over South America during the 1982-83 ENSO EVENT
[INPE-3676-PRE/827] N86-22059
SOVIET SPACECRAFT
Contemporary achievements in astronautics: Salyut-7, the Vega Project and Spacelab
[NASA-TM-77712] N86-21563
SPACE CHARGE
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
Equilibrium states of charged electron beams and space charge compensation processes N86-22292
SPACE COMMERCIALIZATION
Authorizing appropriations for Landsat commercialization
[HR-REPT-99-177] N86-22448
SPACE ENVIRONMENT SIMULATION
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560
SPACE ERECTABLE STRUCTURES
The LATDYN user's manual
[NASA-TM-87635] N86-21953
SPACE EXPLORATION
Use of space dependent on development of space law
[AD-A161397] N86-22449
SPACE HEATING (BUILDINGS)
Passive and hybrid solar systems N86-21986
Solar systems with highly efficient collectors N86-21988
SPACE LAW
Use of space dependent on development of space law
[AD-A161397] N86-22449
SPACE MANUFACTURING
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560
SPACE PLASMAS
Plasmoid motion across a tangential discontinuity (with application to the magnetopause)
[AERONOMICA-ACTA-A-297-1985] N86-22019
Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
SPACE POWER REACTORS
Transient heat pipe investigations for space power systems
[DE86-000613] N86-21806
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
SPACE SHUTTLE MAIN ENGINE
Performance predictions for an SSME configuration with an enlarged throat
[NASA-CR-178740] N86-21579
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
SPACE SHUTTLE ORBITERS
Structural damping of shuttle orbiter and ascent vehicles N86-21904
SPACE SHUTTLE PAYLOADS
The LAMAR telescope module for high throughput imaging and spectroscopy --- Large Area Modular Array of Reflectors (LAMAR) N86-22488
SPACE SHUTTLES
Investigation of solid plume simulation criteria to produce flight plume effects on multibody configuration in wind tunnel tests
[NASA-TP-2569] N86-21507
New proposed dynamic vibration absorbers for excited structures N86-21908
SPACE STATIONS
Manned spaceflight in the nineties: The European perspective
[NASA-TM-77697] N86-21561
Contemporary achievements in astronautics: Salyut-7, the Vega Project and Spacelab
[NASA-TM-77712] N86-21563
Dynamic characteristics of two 300 kW class dual keel space station concepts
[NASA-TM-87680] N86-21569
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113
SPACEBORNE ASTRONOMY
Space research in the Netherlands N86-22456
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461
Capabilities of spectroscopy in the context of X-ray astronomy in the 1900's --- spaceborne astronomy N86-22462
High resolution X-ray spectroscopy of clusters of galaxies --- spaceborne astronomy N86-22465
Stellar activity: The X-ray picture --- spaceborne astronomy N86-22469
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483
The Hyades: EXOSAT broad band spectroscopy --- star cluster N86-22485
Long-term X-ray variability in the Hyades cluster N86-22486
Light weight aluminum optics --- spaceborne x-ray astronomy applications N86-22487
Room temperature solid state spectrometer for X-ray astronomy N86-22497
X-ray polarimetry on XMM --- spaceborne X ray astronomy N86-22500
SPACEBORNE TELESCOPES
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461
The X-ray properties of normal galaxies. What do we know and what can we learn with the next generation of X-ray telescopes? --- spaceborne telescope N86-22466
Instrumentation for X-ray spectroscopy --- spaceborne astronomy N86-22471
Light weight aluminum optics --- spaceborne x-ray astronomy applications N86-22487
The LAMAR telescope module for high throughput imaging and spectroscopy --- Large Area Modular Array of Reflectors (LAMAR) N86-22488
A thin foil high throughput X-ray telescope N86-22489
Carbon-fiber reinforced epoxy techniques for the X-ray Multimirror Mission (XMM) Low-Energy (LE) telescopes N86-22490
Electroform replication of grazing incidence X-ray optics --- spaceborne telescopes N86-22491
SPACECRAFT
Sizing of discrete viscous dampers on a flexible body in the presence of a fixed controller N86-21926
SPACECRAFT COMMUNICATION
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
SPACECRAFT COMPONENTS
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
SPACECRAFT CONTROL
Flexible structure control in the frequency domain N86-21929
SPACECRAFT DESIGN
Damping application to spacecraft N86-21920
SPACECRAFT ENVIRONMENTS
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
SPACECRAFT EQUIPMENT
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether
[NASA-TM-87260] N86-21575
Design and fabrication of a long-life Stirling cycle cooler for space appliction. Phases 1 and 2: Engineering model
[NASA-CR-175288] N86-21714
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715
SPACECRAFT INSTRUMENTS
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
SPACECRAFT LAUNCHING
Analysis of Jimsphere pairs for use in assessing Space Vehicle ascent capability
[NASA-TP-2573] N86-21506
SPACECRAFT MOTION
Simulation of motions of satellites carrying a deployable flexible linkage N86-21568
SPACECRAFT POWER SUPPLIES
Space applications of solar energy systems N86-21996
SPACECRAFT PROPULSION
Spacecraft propulsion systems mass modelling study: Assumptions and definitions N86-21576
SPACECRAFT STABILITY
Fluid slosh studies for spinning spacecraft
[ONERA-RT-8/3269-SY] N86-21807

SPACECRAFT STRUCTURES
Development of spacecraft materials and structures fundamentals
[AD-A161338] N86-21573
SPALLING
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
SPARE PARTS
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
SPATIAL DISTRIBUTION
Space-frequency sampling criteria for electromagnetic scattering of a finite object
[AD-A162553] N86-21737
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261
A study on inclusion formation mechanism in alpha-LiIO sub 3 crystals
[NASA-TM-77943] N86-22417
SPATIAL FILTERING
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Color image processing with computer-generated spatial filters in a dispersed white-light optical system N86-22125
SPECIFICATIONS
F100 fuel sampling analysis
[AD-A161667] N86-21707
Specification and preliminary validation of IAT (Integrated Analysis Techniques) methods: Executive summary
[AD-A162509] N86-21736
Geonames processing system functional design specification. Volume 5: Performance specifications
[AD-A162571] N86-22141
SPECTRA
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Spectral imaging with a CID camera
[AD-A161608] N86-21824
SPECTRAL EMISSION
Extreme ultraviolet emission spectroscopy of atoms and laser applications N86-22313
SPECTRAL LINE WIDTH
Diagnosis of populations and relaxation processes of vibrational and rotational states of moleucles in gases by coherent anti-Stokes scattering spectroscopy N86-22281
SPECTRAL RESOLUTION
Optical acquisition, image and data compression
[AD-A161650] N86-22393
SPECTRAL SIGNATURES
Coincidental chemical signature identifier
[AD-A161269] N86-21637
SPECTRAL THEORY
Optical acquisition, image and data compression
[AD-A161650] N86-22393
SPECTROMETERS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Relative intensity-energy calibration of X-ray photoelectron spectrometers: Instructions for the use of reference materials SCAA83
[NPL-DMA(A)-97] N86-21813
Inelastic scattering in condensed matter with high intensity Moessbauer radiation
[DE86-002461] N86-22321
U9B: Ultraviolet biophysics N86-22357
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406
Analytical applications of ICP-FTS
[DE86-000819] N86-22409
The XMM imaging Bragg spectrometer with a doubly curved crystal N86-22493
Measurements of intrinsic width and mosaicity of test crystals with a novel four-crystal X-ray spectrometer --- spaceborne astronomy N86-22494
Measurements of surface scattering from mirrored surfaces using a triple axis X-ray spectrometer --- X ray telescope development N86-22495
Bolometers as spectrometers for X-ray astronomy N86-22496
Room temperature solid state spectrometer for X-ray astronomy N86-22497
Objective crystal spectrometer (OXS) for imaging extended cosmic X-ray sources N86-22502
SPECTROPHOTOMETRY
An intensified photodiode array applied to one-dimensional auroral imaging N86-22040
SPECTROSCOPIC TELESCOPES
Spectral imaging with a CID camera
[AD-A161608] N86-21824
SPECTROSCOPY
Characterization of carbon fibers and fiber-matrix adhesion in composites N86-21612
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
Extreme ultraviolet emission spectroscopy of atoms and laser applications N86-22313
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356
Gas phase spectroscopy in the soft X-ray region of the U15 beamline N86-22373
SPECTRUM ANALYSIS
Contribution to the photometric determination of small amounts of boron trioxide in glasses
[NASA-TM-77955] N86-21677
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828
Automated instrument for qualitative analysis of photographically recorded spectra
[DE86-001621] N86-21833
Rocket experiments for spectral estimation of electron density fine structure in the auroral and equatorial ionosphere and preliminary results
[NASA-CR-176648] N86-22026
Periodicities in the All India Rainfall series and in the drought and flood area indices
[INPE-3717-PRE/853] N86-22057
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073
Optical acquisition, image and data compression
[AD-A161650] N86-22393
SPHERES
Sizing of polystyrene Spheres produced in microgravity
[PB86-102241] N86-21839
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
SPIN STABILIZATION
Viscous fluid motion in a spinning and nutating cylinder
[AD-A162686] N86-21804
Fluid slosh studies for spinning spacecraft
[ONERA-RT-8/3269-SY] N86-21807
Sizing of discrete viscous dampers on a flexible body in the presence of a fixed controller N86-21926
SPIN-LATTICE RELAXATION
A study of orientational ordering in solid deuterium N86-22315
SPLEEN
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086
SPLINE FUNCTIONS
Modified finite strip method with spline functions N86-21878
SPONTANEOUS COMBUSTION
Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
[PB86-910402] N86-21525
Spontaneous ignition delay characteristics of hydrocarbon fuel-air mixtures
[NASA-CR-175064] N86-21545
SPOT (FRENCH SATELLITE)
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region
[DFVLR-FB-85-49] N86-21972
SPREAD SPECTRUM TRANSMISSION
Spread spectrum acquisition and tracking
[AD-A162442] N86-21734
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading
[AD-A162495] N86-21735
SPUTTERING
Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851
STABILITY
Morphological stability of continuous intergranular phases
[DE86-001483] N86-21701
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
On prediction of harmonizable stable processes
[AD-A161412] N86-22210
Equilibrium states of charged electron beams and space charge compensation processes N86-22292
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382
STABILITY AUGMENTATION
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
STACKS
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
STAGNATION FLOW
Studies of acoustic effects on a flow boundary layer in air
[NASA-TM-77981] N86-21792
STAGNATION TEMPERATURE
Thermal sensing of cryogenic wind tunnel model surfaces
[NASA-CR-176641] N86-21557
STAINLESS STEELS
Controlled powder morphology experiments in megabar 304 stainless steel compaction
[DE86-002416] N86-21672
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
STANDARD DEVIATION
Sizing of polystyrene Spheres produced in microgravity
[PB86-102241] N86-21839
STANDARDIZATION
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
STANDARDS
Minimum operational performance standards for airborne Distance Measuring Equipment (DME) operation within the radio frequency range of 960-1215 megahertz
[RTCA/DO-189] N86-21542
Handbook for SRM (Standard Reference Materials) users
[PB86-110897] N86-21649
The measuring assembly for a primary standard absorbed dose calorimeter --- high energy particle beams
[NPL-RS(EXT)-74] N86-21814
STAR CLUSTERS
The Hyades: EXOSAT broad band spectroscopy --- star cluster N86-22485
Long-term X-ray variability in the Hyades cluster N86-22486
STAR TRACKERS
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567
STATIC DEFORMATION
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307
STATIC LOADS
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
STATISTICAL ANALYSIS
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
Average loss factors for use in statistical energy analysis N86-21906
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22081
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105

Methods of conceptual clustering and their relation to numerical taxonomy
[AD-A160221] N86-22191
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240
Statistical methodologies appropriate in censored survival analyses and competing risk models
[AD-A162703] N86-22245

STATISTICAL DISTRIBUTIONS
Random integral representations for classes of limit distributions similar to Levy class L(O)
[AD-A161413] N86-22235
The 25th Conference on Statistical Theory and Practice held at the University of Wisconsin, Madison on 29-31 May 1985
[AD-A162645] N86-22244

STATISTICAL MECHANICS
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695

STATISTICAL TESTS
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163
Investigations on statistics of terrain height
[AD-A162517] N86-22243

STATOR BLADES
Damping applications in turbine engines N86-21888

STEADY STATE
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239

STEAM TURBINES
Damping properties of steam turbine blades N86-21890

STEELS
A study of precipitation and segregation on an atomic scale of 11at.percentCr-lat.percentMo heat resisting steel by atom-probe and TEM (Transmission Electron Microscope)
[AD-A161590] N86-21664

STELLAR ACTIVITY
Stellar activity: The X-ray picture --- spaceborne astronomy N86-22469

STELLAR CORONAS
Dispersive X-ray spectroscopy with transmission gratings --- X ray astronomy N86-22492

STELLAR MASS ACCRETION
Accreting neutron stars in close binary systems N86-22468

STELLAR SPECTRA
The X-ray spectroscopic study of the interstellar medium N86-22470
The X-ray spectrum of emission line stars (superluminous and symbiotic) N86-22472
The X-ray spectra of bursting neutron stars: Effects of Comptonization and bound-free opacity N86-22475
The X-ray spectra and the rotation-activity connection of RS CVN binaries N86-22482
The Hyades: EXOSAT broad band spectroscopy --- star cluster N86-22485

STELLAR SPECTROPHOTOMETRY
Optical, UV and X-ray observations of X-ray binaries N86-22473
EXOSAT CMA observations of X0512-401 = NGC 1851 --- X ray source N86-22477

STELLARATORS
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411

STIFFNESS
Some musings on how to make damping a creative force in design N86-21884
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
Damping measurement by dynamic stiffness methods N86-21902

STIMULATED EMISSION
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses
[NASA-TM-77903] N86-21841
Generation of picosecond pulses in monopulse-pumped dye lasers N86-22271

STIMULATION
Photon stimulted desoprtion of ions from polymer surfaces N86-22367

STIRLING CYCLE
A new chromium carbide-based tribological coating for use to 900 deg C with particular reference to the Stirling engine
[NASA-TM-87274] N86-21682
Design and fabrication of a long-life Stirling cycle cooler for space appliction. Phases 1 and 2: Engineering model
[NASA-CR-175286] N86-21714
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715
A small free-piston Stirling refrigerator N86-21716
Basic principles of the Stirling cycle N86-21717
Free-piston Stirling engine development
[PB86-102746] N86-21872

STOCHASTIC PROCESSES
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
Stochastic analysis of drought phenomena
[AD-A160947] N86-22060
Prediction of stochastic processes using self-tuning principles
[OUEL-1597/85] N86-22200
Finite element method analysis of nonlinear continua using stochastic equivalent linearization technique N86-22202
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206
On stochastical integration by series of Wiener integrals
[AD-A161514] N86-22211
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240

STORAGE BATTERIES
Electrolyte for lithium-inorganic non-aqueous rechargeable cell system and rechargeable cell system including said electrolyte
[AD-D011976] N86-21647
Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979

STORAGE RINGS (PARTICLE ACCELERATORS)
Measurements of proton-proton and proton-antiproton elastic scattering at the European Center for Nuclear Research Intersecting Storage Rings N86-22324
Activity of the National Synchrotron Light Source (NSLS)
[BNL-51840] N86-22326
Beam line U5: (FEL and diagnostic line) N86-22330

STORAGE STABILITY
Application of hydrogen analysis to the compatibility testing and long-term aging of explosives
[DE86-001689] N86-21713

STORM SUPPRESSION
Weather radar studies
[AD-A161622] N86-22061

STRAIN ENERGY METHODS
Finite element design of viscoelastically damped structures N86-21910
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928

STRAIN GAGES
Demonstration test of burner liner strain measuring system
[NASA-CR-174743] N86-21817
Impact dynamics instrumentation N86-21948

STRAIN HARDENING
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665

STRAIN MEASUREMENT
Demonstration test of burner liner strain measuring system
[NASA-CR-174743] N86-21817
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886
Average loss factors for use in statistical energy analysis N86-21908

STRAIN RATE
A large strain finite element formulation for one dimensional membrane elements --- soil mechanics
[OUEL-1603/85] N86-22226
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[DFVLR-FB-85-56] N86-22399

STRAKES
Measurements of the symmetric aerodynamic coefficients for flat faced cylinders with strakes in the angle of attack regime 70 to 90 deg for transonic speed
[FFA-TN-1985-39] N86-21523

STRATIFICATION
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076

STRATIGRAPHY
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176822] N86-22510
The materials and formation of the imbrium basin N86-22525

STRESS (PHYSIOLOGY)
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109

STRESS ANALYSIS
Experimental measurement of material damping for space structures N86-21887
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
Finite element analysis of two cylindrical expansion problems involving near incompressible material behaviour
[OUEL-1580/85] N86-22227
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
A measurement of the effect of intrinsic film stress on the overall rate of thermal oxidation of silicon
[AD-A161634] N86-22422

STRESS CONCENTRATION
Asymptotic analysis of a mode 1 crack propagating steadily in a deformation theory material
[AD-A161770] N86-21689
Shear stress concentration near the edge of a thin film deposited on a substrate N86-21880

STRESS CORROSION
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950

STRESS CORROSION CRACKING
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960

STRESS MEASUREMENT
Controlled impact demonstration airframe bending bridges N86-21943
CID-720 aircraft high-environment flight instrumentation system N86-21947
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420

STRESS-STRAIN RELATIONSHIPS
Design of notched plates under compression N86-21594
Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964

STRESSES
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522

STRONTIUM ZIRCONATES
Structure and electrical properties of strontium zirconate N86-21751

STRUCTURAL ANALYSIS
Stochastic non-linear flutter of aeroelastic structures
[AD-A162748] N86-21552
Integrated Composite Analyzer (ICAN): Users and programmers manual
[NASA-TP-2515] N86-21614
Finite element design of viscoelastically damped structures N86-21910
Results of finite element analysis of damped structures N86-21912
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
Controlled impact demonstration airframe bending bridges N86-21943
CID-720 aircraft high-environment flight instrumentation system N86-21947

Equivalent plate analysis of aircraft wing box structures with general planform geometry
[NASA-TM-87697] N86-21954
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide
[AD-A161324] N86-22158
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431

STRUCTURAL BASINS
Ground response in alluvial basins due to seismic disturbances
[AD-A162467] N86-22047
Spectral reflectance study of the Hadley-Appenine (Apollo 15) region N86-22521
The materials and formation of the imbrium basin N86-22525
Geologic setting of the Apollo 15 landing site N86-22529

STRUCTURAL DESIGN
Development of high order finite elements to model filament wound composites N86-21593
Research and development of a high average power photoprocessing laser system N86-21840
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
Volumetric trochoidal gas compressor for use as a heat pump
[PB86-102720] N86-21871
Vibration Damping 1984 Workshop Proceedings
[AD-A152547] N86-21883
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21894
High resolution acoustic microscopy N86-22301

STRUCTURAL DESIGN CRITERIA
Some musings on how to make damping a creative force in design N86-21884
Concepts and effects of damping in isolators N86-21891
A comparison of measured spacecraft modal damping values N86-21903
Structural damping of shuttle orbiter and ascent vehicles N86-21904
Laminated damped fuselage structures N86-21916
Integrated damped fuselage structure N86-21918
Aeroacoustics of contoured and solid/porous conical plug-nozzle supersonic jet flows
[NASA-CR-176645] N86-22308

STRUCTURAL ENGINEERING
Some musings on how to make damping a creative force in design N86-21884

STRUCTURAL FAILURE
Controlled impact demonstration airframe bending bridges N86-21943
Impact dynamics instrumentation N86-21948

STRUCTURAL MEMBERS
Microvoltammetric electrodes
[AD-A161653] N86-21642
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
Passive and Active Control Of Space Structures (PACOSS) N86-21931
Surface analysis of space telescope material specimens
[NASA-CR-178712] N86-22460

STRUCTURAL PROPERTIES (GEOLOGY)
Meteorite craters
[NASA-TM-78013] N86-22507
Hadley Rille, lava tubes and mare volcanism at the Apollo 15 site N86-22516
The geologic history of quartz-normative and olivine-normative basalts in the vicinity of Hadley Rille (Apollo 15) N86-22517

STRUCTURAL STABILITY
Some musings on how to make damping a creative force in design N86-21884

STRUCTURAL STRAIN
Finite element analysis of the Roquefort diagnostic canister
[DE86-000837] N86-22184

STRUCTURAL VIBRATION
Experimental-theoretical study of velocity feedback damping of structural vibrations N86-21853
Characteristics of dry friction damping N86-21889
Friction damping studies at Imperial College N86-21893
Structural damping potential of waveguide absorbers N86-21907
Damping in support structures for satellite equipment reliability: RELSAT N86-21922
A design guide for damping of aerospace structures N86-21923
Passively damped joints for advanced space structures N86-21930
Studies of acoustical fields generated by vibrating structures with applications to noise control by design N86-22300
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

SUBCRITICAL MASS
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378

SUBMILLIMETER WAVES
An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377

SUBROUTINES
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

SUBSONIC FLOW
A direct method to calculate disturbance fields of moving bodies at subsonic speeds in compressible media
[DFVLR-FB-85-52] N86-21812

SUBSTRATES
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
A computer program to calculate the resistivity of a thin film deposited on a conductive substrate from four-point probe measurements
[NASA-TM-87262] N86-22150
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Polyimide and the polymer-metal interaction N86-22346
Investigations of the etching chemistry of electronic materials N86-22347
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428

SUCTION
Vortical flows about oscillating airfoil with surface suction N86-21502

SULFONES
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-2] N86-21675

SULFUR
Neighboring group participation in solvolysis of organosulfur and related compounds
[AD-A161458] N86-21587

SULFUR COMPOUNDS
An experimental evaluation of the effects of selected organic compounds on the formation of insolubles in diesel fuels
[AD-A161323] N86-21586

SULFUR ISOTOPES
Fusion and fission studies for the system S-32 + U-238 N86-22404

SULFUR OXIDES
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646

SUMMER
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102

SUPERCOMPUTERS
An analysis and simulation of the CRAY X-MP memory system
[AD-A162769] N86-22190

SUPERCONDUCTING MAGNETS
A pulsed magnetohydrodynamic generator with a superconducting magnetic system
[AD-A161812] N86-22405
Magnetic systems for fusion devices
[DE86-000743] N86-22407

SUPERCONDUCTIVITY
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299
A pulsed magnetohydrodynamic generator with a superconducting magnetic system
[AD-A161812] N86-22405
Superconductivity in the actinides
[DE86-000786] N86-22433

SUPERCONDUCTORS
Improvements in the weldability of a superconductor sheath material
[DE86-000748] N86-21867
Squeezable tunnel junctions
[AD-A161537] N86-22419
A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423

SUPERNOVA REMNANTS
The X-ray spectroscopy of supernova remnants N86-22467
Nonionization equilibrium effects in the supernova remnant (SNR) RCW 86 — X ray astronomy N86-22474
Interpretation of the oxygen 7 soft X-ray spectrum from the Puppis-A supernova remnant N86-22481

SUPERPLASTICITY
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662

SUPERSONIC FLOW
Investigation of Ferri instability in supersonic inlets
[DFVLR-FB-85-53] N86-21524

SUPERSONIC FLUTTER
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513

SUPERSONIC INLETS
Investigation of Ferri instability in supersonic inlets
[DFVLR-FB-85-53] N86-21524

SUPERSONIC JET FLOW
Coherent large-scale structures in high Reynolds number supersonic jets
[NASA-CR-3952] N86-22303
Aeroacoustics of contoured and solid/porous conical plug-nozzle supersonic jet flows
[NASA-CR-176645] N86-22308

SUPPORT SYSTEMS
Decision support system for ASD (Aeronatical Systems Division) program managers
[AD-A161690] N86-22137

SUPPORTS
Drop foot corrective device
[NASA-CASE-LAR-12259-2] N86-22112

SURFACE ACOUSTIC WAVE DEVICES
SAW (Surface Acoustic Wave) transition detector for PSK (Phase Shift Keying) signals
[AD-D011974] N86-21740

SURFACE DEFECTS
A new NDE method for coated carbon-carbon composites
[AD-D011978] N86-21625

SURFACE DIFFUSION
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

SURFACE ENERGY
Surface states on simple metal surfaces N86-22328

SURFACE FINISHING
The effects of surface finish and grain size on the strength of sintered silicon carbide
[NASA-TM-77871] N86-21616
Computer Controller Optical Surfacing (CCOS) lap pressure control system
[AD-D011985] N86-21805
Studies of the Ta(110) surface and hydrogen on Ta(110) N86-22342

SURFACE LAYERS
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666

SURFACE NAVIGATION
Mariners Weather Log, Volume 29, Number 3: Summer, 1985
[PB86-108313] N86-22066

SURFACE PROPERTIES
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512
Microvoltammetric electrodes
[AD-A161653] N86-21642
Evaluation of a standard test method for total hemispherical emittance of surfaces from 293K to 1673K
[NASA-TM-87681] N86-21660
Re-evaluation of surface properties of oxide-cathode materials
[AD-A161131] N86-21687
A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513

SURFACE REACTIONS
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425
SURFACE ROUGHNESS
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
Surface discharge through an insulator in a vacuum
[NASA-TM-77936] N86-21756
Elastodynamic scattering by periodic surface indentations N86-21882
SURFACE VEHICLES
Personnel emergency carrier vehicle
[NASA-CASE-KSC-11282-1] N86-22452
SURFACES
A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653
SURFACTANTS
Characterization of vesicle and microemulsion microstructures
[AD-A161459] N86-21639
Particulate models of photosynthesis
[DE86-001625] N86-22090
SURVIVAL
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Statistical methodologies appropriate in censored survival analyses and competing risk models
[AD-A162703] N86-22245
SWEAT
Electrodermal changes corresponding to the degree of discomfort induced by motion sickness
[NAL-TR-880] N86-22096
SWEPT FORWARD WINGS
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
SWIRLING
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580
SWITCHES
Electrically excited phenomena in gas-phase devices
[AD-A161527] N86-21764
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
SWITCHING
Wavelength switching in copper-vapor lasers N86-22275
SWITCHING CIRCUITS
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
SYMBIOTIC STARS
The X-ray spectrum of emission line stars (superluminous and symbiotic) N86-22472
SYNCHRONOUS SATELLITES
TV-SAT final orbit acquisition optimization strategy
[INPE-3679-PRE/829] N86-21570
SYNCHROTRON RADIATION
Metal-insulator transition on the Ge(001) surface N86-22327
Surface states on simple metal surfaces N86-22328
Angle resolved photoemission studies of electronic structure N86-22329
Undulator based beamline studies on U5 N86-22331
X-ray lithography: Beamline U6 N86-22332
Fragmentation of small molecules following soft X-ray absorption near the carbon K-edge N86-22333
Core level shifts and electronic structure of Cu3Au N86-22334
Angle resolved photoemission and band structure of Cu3Au N86-22335
Photon energy dependent branching ratios of the inner valence satellites in the photoemission of solid ethylene N86-22336
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
Photon desorption studies of synchrotron materials N86-22339
The adsorption of carbon monoxide on palladium films N86-22340
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Studies of the Ta(110) surface and hydrogen on Ta(110) N86-22342
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344
Oxidation of GaSs(110) cleaved surface N86-22345
Polyimide and the polymer-metal interaction N86-22346
Investigations of the etching chemistry of electronic materials N86-22347
High resolution photoemission investigation: The oxidation of W N86-22348
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349
Applications of tunable VUV radiation N86-22350
Reflectance measurements of aluminum coatings at 200 - 500 nm N86-22351
UV-VUV circular dichroism spectrometer N86-22352
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
VUV optical properties of cadmium dimethyl N86-22354
Photodissociation of vinyl cyanide N86-22355
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356
U9B: Ultraviolet biophysics N86-22357
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g) N86-22359
Measurement of the dissociation energies of gas phase neutral dimers by a photoionization technique N86-22360
Energy flow in van der Waals molecules N86-22361
Photoelectron spectroscopy of autoionizing Rydburg states in small molecules N86-22362
Deexcitation electron spectroscopy of free and coordinated CO N86-22363
Surface sensitive photoemission EXAFS: A new structural tool N86-22364
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl N86-22366
Photon stimulted desoprtion of ions from polymer surfaces N86-22367
Resonance valence-band photoemission and h Nu dependent 3p photoemission of MnF2 N86-22368
Resonant photoemission studies of f-electron systems performed on station U14 N86-22369
Contact X-ray microscopy of biological materials N86-22370
X-ray holography experiments on the U15 beam line N86-22371
Scanning soft X-ray microscopy on the U15 beam line N86-22372
Gas phase spectroscopy in the soft X-ray region of the U15 beamline N86-22373
SYNCHROTRONS
Activity of the National Synchrotron Light Source (NSLS)
[BNL-51840] N86-22326
SYNTHESIS (CHEMISTRY)
Perfluoro (Imidoylamidine) diamidines
[NASA-CASE-ARC-11402-3] N86-21582
Synthesis of pyromellitic acid esters
[NASA-TM-77977] N86-21583
Studies on the oxidation of hexamethylbenzene 1: Oxidation of hexamethylbenzene with nitric acid
[NASA-TM-77945] N86-21628
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-2] N86-21675
Thermosetting arylether compounds and their synthesis
[AD-D012025] N86-21676
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N86-21685
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692
Chemical preparation of high-field zinc oxide varistors
[DE86-001611] N86-21784
Improved amphoteric ion exchanger and its manufacturing method
[DE86-001608] N86-21836
Bimane derivatives as fluorescent probes for biological macromolecules
[AD-A162725] N86-22088
SYNTHETIC APERTURES
Synthetic aperture multi-telescope tracker apparatus
[AD-D011981] N86-22506
SYNTHETIC RESINS
A design guide for damping of aerospace structures N86-21923
Distributed piezoelectric-polymer active vibration control of a cantilever beam N86-21924
SYSTEM EFFECTIVENESS
Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514
Prototype RECOVER system hardware and software review and future remote monitoring system philosophy. POTAS Task E.59 remote monitoring design review
[DE86-001681] N86-21574
Artificial intelligence and its use in cost type analyses with and example in cost performance measurement
[AD-A161817] N86-22168
Initial and qualification operational test and evaluation in the acquisition of non-major communication systems
[AD-A161729] N86-22439
SYSTEM IDENTIFICATION
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549
SYSTEMS ANALYSIS
Specification and preliminary validation of IAT (Integrated Analysis Techniques) methods: Executive summary
[AD-A162509] N86-21736
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
The RANDOM computer program: A linear congruential random number generator
[NASA-CR-176664] N86-22152
The SIMRAND methodology: Theory and application for the simulation of research and development projects
[NASA-CR-176663] N86-22153
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
Robust adaptive control
[AD-A161349] N86-22192
SYSTEMS ENGINEERING
Prototype RECOVER system hardware and software review and future remote monitoring system philosophy. POTAS Task E.59 remote monitoring design review
[DE86-001681] N86-21574
Maintenance planning for the 1990's (initial planning)
[PB86-106010] N86-22065
BUILD: A tool for maintaining consistency in modular systems
[AD-A162744] N86-22180
Bimodal optical computer
[AD-A161399] N86-22187
Robust adaptive control
[AD-A161349] N86-22192
Optical acquisition, image and data compression
[AD-A161650] N86-22393
SYSTEMS MANAGEMENT
Development of a microprocessor controller for stand-alone photovoltaic power systems
[NASA-CR-174723] N86-21979
SYSTEMS STABILITY
Normality scaling and eigenvalue inclusion regions — multivariable feedback systems
[OUEL-1594/85] N86-22249

T

TANGENTS
Plasmoid motion across a tangential discontinuity (with application to the magnetopause)
[AERONOMICA-ACTA-A-297-1985] N86-22019
TANTALUM
Studies of the Ta(110) surface and hydrogen on Ta(110) N86-22342
TAPE RECORDERS
The RTJ1200 video amplifier. Investigation of low noise, low distortion amplifiers for low source impedance
[REPT-52/83/54] N86-21753
TARGET RECOGNITION
Space-frequency sampling criteria for electromagnetic scattering of a finite object
[AD-A162553] N86-21737
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104
Two new approximate solution techniques for a moving target problem when searcher motion is constrained
[AD-A162491] N86-22171
TARGET SIMULATORS
Infrared sensor target
[AD-D011996] N86-22398

TEARING
Contribution of bending energy losses to the apparent tear energy
[AD-A162775] N86-21696
A simulation program with latency exploitation and node tearing
[AD-A161379] N86-21762
TEARING MODES (PLASMAS)
Analytic theory of the nonlinear M = 1 tearing mode
[DE86-001783] N86-22412
TECHNOLOGICAL FORECASTING
Structural materials in aeronautics: Prospects and perspectives
[RAE-TR-85077] N86-21532
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
TECHNOLOGY ASSESSMENT
State-of-the-art review on composite material fatigue/damage tolerance
[FAA/CT-85/7] N86-21615
Experiences with solar power N86-21994
Technology assessment of solar energy utilization N86-21995
Japanese Technology Evaluation Program (JTECH): Biotechnology Panel
[PB86-109386] N86-22092
Exploring the utility of a staged technology assessment process, volume 1
[PB86-109402] N86-22453
Exploring the utility of a staged technology assessment process, volume 2
[PB86-109410] N86-22454
TECHNOLOGY TRANSFER
Japan report: Science and technology
[JPRS-JST-86-001] N86-21723
Installing a copy of the ARPA/DMA image understanding testbed at the US Army Engineer Topographic Laboratories
[AD-A158394] N86-21818
TECHNOLOGY UTILIZATION
Structural materials in aeronautics: Prospects and perspectives
[RAE-TR-85077] N86-21532
Role of hydrogen in solar energy utilization: Problems and aspects of the hydrogen issue N86-21993
Technology assessment of solar energy utilization N86-21995
Space applications of solar energy systems N86-21996
TELECOMMUNICATION
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading
[AD-A162495] N86-21735
Automated generation of microcontrollers
[AD-A162668] N86-21775
TELECONFERENCING
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
TELEMETRY
Controlled impact demonstration on-board (interior) photographic system N86-21946
TELESCOPES
Synthetic aperture multi-telescope tracker apparatus
[AD-D011961] N86-22506
TELEVISION CAMERAS
Automated weld torch guidance control system
[NASA-CASE-MFS-25807-2] N86-21850
TELLURIUM
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
TEMPERATURE DEPENDENCE
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[DFVLR-FB-85-56] N86-22399
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428
TEMPERATURE DISTRIBUTION
Heat release effects in a turbulent, reacting shear layer N86-21788
The dynamics of heat transfer in a turbulent pipe flow, part 2
[OEFZS-4325-PT-2] N86-21808
Burner liner thermal-structural load modeling
[NASA-CR-174892] N86-21932
Thermal deformation of concentrators in an axisymmetric temperature field
[NASA-TM-77935] N86-21977
TEMPERATURE EFFECTS
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11538-1SB] N86-21590
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
Thermo-mechanical and thermal behavior of high-temperature structural materials
[AD-A161741] N86-21959
Method of determining the thermal deformations of astronomical mirrors
[NASA-TM-77941] N86-22457
TEMPERATURE GRADIENTS
Modeling the curing process of thick-section autoclave cured composites N86-21600
Multidimensional high-resolution gas chromatographic investigations of hydrocarbon fuels and various turbine engine fuel precursors
[AD-A162660] N86-21709
TEMPERATURE MEASUREMENT
Thermal sensing of cryogenic wind tunnel model surfaces
[NASA-CR-176641] N86-21557
TEMPERATURE PROFILES
Prototype salvage foaming system
[AD-A161499] N86-21688
TENSILE PROPERTIES
Thermally induced stresses and deformations in layered composite tubes N86-21598
Analysis and experiments on interlaminar fracture toughness in resin matrix composites
[AD-A162689] N86-21622
Effect of boron on tensile properties of B2 BeAl
[NASA-CR-175074] N86-21656
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
TENSILE STRENGTH
The electroplating of laminated chromium
[AD-A162751] N86-21671
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
TENSILE STRESS
Behaviour of fibre-reinforced composites under dynamic tension
[OUEL-1602/85] N86-21626
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960
TENSILE TESTS
Fracture morphology of 2-D carbon-carbon composition N86-21599
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950
TERNARY ALLOYS
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670
TERRAIN
NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054
Studies of complex-terrain flows using acoustic remote sensors
[PB86-100138] N86-22068
Investigations on statistics of terrain height
[AD-A162517] N86-22243
TEST CHAMBERS
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
TEST EQUIPMENT
Test fixture effects in vibration tests of rocket motors
[AD-A161403] N86-21581
TEST FACILITIES
The development of a heat transfer measurement technique for application to rotating turbine blades
[OUEL-1584/85] N86-21810
TEXTURES
Rubber removal specification development
[FAA/PM-85/33] N86-21555
THEMATIC MAPPING
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data
[NASA-CR-176660] N86-21970
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region
[DFVLR-FB-85-49] N86-21972
THERMAL ANALYSIS
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
THERMAL BLOOMING
Laser propagation code study
[AD-A161370] N86-21842
THERMAL BUCKLING
Thermal deformation of concentrators in an axisymmetric temperature field
[NASA-TM-77935] N86-21977
THERMAL CONDUCTIVITY
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
Study of transport properties and structure of extended-chain polymers
[AD-A162765] N86-21694
Thermo-mechanical and thermal behavior of high-temperature structural materials
[AD-A161741] N86-21959
THERMAL DEGRADATION
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
THERMAL DIFFUSION
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
A diffuser heat transfer and erosion code
[AD-A162436] N86-21802
Thermo-mechanical and thermal behavior of high-temperature structural materials
[AD-A161741] N86-21959
THERMAL DISSOCIATION
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air N86-21632
THERMAL EXPANSION
The electroplating of laminated chromium
[AD-A162751] N86-21671
THERMAL FATIGUE
Thermal mechanical fatigue crack growth. An application for fracture mechanics analyses of gas turbine engine disks
[AD-A162634] N86-21962
THERMAL INSULATION
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
Transparent superinsulating materials: New aspects in solar technology --- silica gel N86-21987
THERMAL PROTECTION
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
THERMAL STABILITY
An experimental evaluation of the effects of selected organic compounds on the formation of insolubles in diesel fuels
[AD-A161323] N86-21586
Studies on the oxidation of hexamethylbenzene 2: Preparation of dimethylpyromellitic acid
[NASA-TM-77946] N86-21629
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
Development of an elevated temperature aluminum alloy containing Al3X-type dispersed phases N86-21650
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-2] N86-21675
THERMAL STRESSES
Thermally induced stresses and deformations in layered composite tubes N86-21598
Defect inspection of solid fuel propeliant cylinders by means of laser holographic techniques
[AD-A162746] N86-21710
Thermo-mechanical and thermal behavior of high-temperature structural materials
[AD-A161741] N86-21959
Method of determining the thermal deformations of astronomical mirrors
[NASA-TM-77941] N86-22457
THERMALIZATION (ENERGY ABSORPTION)
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities
[NAL-TR-866T] N86-22314

THERMOCHEMICAL PROPERTIES
Synthesis of pyromellitic acid esters
[NASA-TM-77977] N86-21583
THERMOCHEMISTRY
Drop tube technical tasks
[NASA-CR-178741] N86-21564
Photochemical, electrochemical and thermochemical transformation and storage of solar energy: Thermodynamic aspects N86-21991
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
Silicon oxidation studies. Silicon orientation effects on thermal oxidation
[AD-A161633] N86-22421
A measurement of the effect of intrinsic film stress on the overall rate of thermal oxidation of silicon
[AD-A161634] N86-22422
THERMODYNAMIC PROPERTIES
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162528] N86-22006
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
THERMODYNAMICS
Drop tube technical tasks
[NASA-CR-178741] N86-21564
Morphological stability of continuous intergranular phases
[DE86-001483] N86-21701
Thermo-mechanical and thermal behavior of high-temperature structural materials
[AD-A161741] N86-21959
THERMONUCLEAR POWER GENERATION
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411
THERMOPLASTIC RESINS
Thermoplastic matrix composite processing model
[NASA-CR-176639] N86-21619
THERMOSETTING RESINS
Chemical modification of matrix resin networks with engineering thermoplastics: Morphology and properties of poly(aryl ether sulfone) modified epoxy networks N86-21613
Thermosetting arylether compounds and their synthesis
[AD-D012025] N86-21676
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
THERMOSPHERE
Initial simulations of the high latitude thermosphere and ionosphere with a coupled three dimensional model N86-22039
THICKNESS
Modeling the curing process of thick-section autoclave cured composites N86-21600
Fracture of thick graphite/epoxy laminates with part-through surface flaws N86-21611
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
THIN FILMS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851
Shear stress concentration near the edge of a thin film deposited on a substrate N86-21880
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000
A computer program to calculate the resistivity of a thin film deposited on a conductive substrate from four-point probe measurements
[NASA-TM-87262] N86-22150
The adsorption of carbon monoxide on palladium films N86-22340
Thin-film chemical sensors based on electron tunneling
[NASA-CR-176662] N86-22418
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
A measurement of the effect of intrinsic film stress on the overall rate of thermal oxidation of silicon
[AD-A161634] N86-22422
Models for the oxidation of silicon
[AD-A161751] N86-22424
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431
THIN WALLS
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
THORIUM
Investigation of chemical durability mechanism in fluoride glasses
[AD-A162740] N86-21693
THREE DIMENSIONAL BOUNDARY LAYER
Three-dimensional boundary layer analysis program Blay and its application
[NASA-TM-77982] N86-21516
THREE DIMENSIONAL FLOW
Improvements and application of a new type of three component laser Doppler velocimeter
[VKI-TM-37] N86-21837
THROATS
Performance predictions for an SSME configuration with an enlarged throat
[NASA-CR-178740] N86-21579
THROMBIN
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099
THRUST CONTROL
Procedure for utilizing the lift and thrust forces of ornithopters
[NASA-TM-77682] N86-21534
THRUST VECTOR CONTROL
Propulsion and control propellers with thruster nozzles primarily for aircraft applications
[NASA-TM-77715] N86-21511
THUNDERSTORMS
Weather radar studies
[AD-A161622] N86-22061
TIDES
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052
TILES
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410
TIME
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
Complexity of the generalized mover's problem
[AD-A161378] N86-22209
TIME CONSTANT
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
TIME DEPENDENCE
Control of missile dispersion via roll rate modulation
[AD-A162542] N86-21565
An adaptive mesh algorithm for solving systems of time dependent partial differential equations
[AD-A161822] N86-22215
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535
TIME MEASUREMENT
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
TIME MEASURING INSTRUMENTS
Prototype salvage foaming system
[AD-A161499] N86-21688
TIME SERIES ANALYSIS
Stochastic analysis of drought phenomena
[AD-A160947] N86-22060
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234
Stationary time series, quantile functions, nonparametric inference and rank transform spectrum
[AD-A161749] N86-22238
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
The 25th Conference on Statistical Theory and Practice held at the University of Wisconsin, Madison on 29-31 May 1985
[AD-A162645] N86-22244
TIME SHARING
Development and use of the Life Cycle Cost In Design computer program (LCCID)
[AD-A162522] N86-22174
TIME TEMPERATURE PARAMETER
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
TIN
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21624
TISSUES (BIOLOGY)
Proceedings: Protons and Membrane Reactions held at Santa Barbara, California on 28 January - 1 February 1985
[AD-A161331] N86-22082
TITANIUM
Interface structure and electronic properties of the titanium-silicon system N86-21749
TITANIUM BORIDES
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
TOKAMAK DEVICES
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410
Analytic theory of the nonlinear M = 1 tearing mode
[DE86-001783] N86-22412
TOLERANCES (PHYSIOLOGY)
Toxic hazards research unit annual technical report: 1985
[AD-A161558] N86-22097
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
TOPOGRAPHY
Desert studies: A global view
[AD-A161453] N86-21971
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
TOPOLOGY
CWI Newsletter, no. 2, March 1984
[CWI-NEWSLETTER-2] N86-22117
Two applications of topological dynamics in combinatorial number theory N86-22118
Set theory and topology N86-22123
The role of the topological distance matrix in chemistry
[AD-A162523] N86-22252
TOROIDAL PLASMAS
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411
TORQUE
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950
TORSION
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
TORSIONAL STRESS
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950
TORSIONAL VIBRATION
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
TORUSES
Development of research tools to study structure and evolution in the intermediate altitude regime
[AD-A162707] N86-22376
TOUGHNESS
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11538-1SB] N86-21590
Transformation toughened ceramics for the heavy duty diesel engine technology program, phase 2
[NASA-CR-175054] N86-22451
TOXIC HAZARDS
Toxic hazards research unit annual technical report: 1985
[AD-A161558] N86-22097

TOXICITY
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants
[AD-A162444] N86-22085
TRACKING (POSITION)
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Spread spectrum acquisition and tracking
[AD-A162442] N86-21734
Weather radar studies
[AD-A161622] N86-22061
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
TRAFFIC
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
TRAILING EDGES
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack
[AD-A162407] N86-21801
TRAINING ANALYSIS
Emergency Management Computer-Aided Trainer (EMCAT)
[NASA-CR-178738] N86-21554
TRAJECTORIES
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
TRAJECTORY CONTROL
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865
TRAJECTORY OPTIMIZATION
Robust adaptive control
[AD-A161349] N86-22192
TRANSDUCERS
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
Impact dynamics instrumentation N86-21948
High resolution acoustic microscopy N86-22301
TRANSFER FUNCTIONS
Friction damping studies at Imperial College N86-21893
A comparison of measured spacecraft modal damping values N86-21903
Principal direction alignment, a geometric framework for the computer solution to the mu-problem --- control theory
[OUEL-1595/85] N86-22198
TRANSFERRING
Behavior of singlet oxygen in the oxygen-iodine transfer laser
[AD-A161390] N86-21843
TRANSFORMATIONS (MATHEMATICS)
Stationary time series, quantile functions, nonparametric inference and rank transform spectrum
[AD-A161749] N86-22238
Optical acquisition, image and data compression
[AD-A161650] N86-22393
TRANSIENT LOADS
The LATDYN user's manual
[NASA-TM-87635] N86-21953
TRANSISTOR CIRCUITS
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits
[AD-A161371] N86-21761
A simulation program with latency exploitation and node tearing
[AD-A161379] N86-21762
TRANSISTORS
Performance limits of scaled CMOS analog ICs N86-21748
Spectral imaging with a CID camera
[AD-A161608] N86-21824
TRANSITION METALS
Boronnitride and siliconnitride systems
[AD-A161563] N86-21640
Host materials for transition-metal ions with the ndN electronic configuration
[AD-A161782] N86-21846
Resonance valence-band photoemission and h Nu dependent 3p photoemission of MnF2 N86-22368
TRANSITION PROBABILITIES
Markov chains with rare transitions and simulated annealing
[AD-A161598] N86-22237
TRANSITION TEMPERATURE
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
TRANSMITTANCE
Radiative interactions in transient energy transfer in gaseous systems
[NASA-CR-176644] N86-21798
TRANSMITTER RECEIVERS
Minimum operational performance standards for airborne Distance Measuring Equipment (DME) operation within the radio frequency range of 960-1215 megahertz
[RTCA/DO-189] N86-21542
TRANSONIC FLOW
A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508
Measurements of the symmetric aerodynamic coefficients for flat faced cylinders with strakes in the angle of attack regime 70 to 90 deg for transonic speed
[FFA-TN-1985-39] N86-21523
TRANSONIC SPEED
A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508
TRANSPONDERS
Damping in support structures for satellite equipment reliability: RELSAT N86-21922
TRANSPORT AIRCRAFT
Aircraft interior panel test criteria derived from full-scale fire tests
[AD-A161637] N86-21529
CID overview N86-21934
NASA experiments on the B-720 structure and seats N86-21936
NASA seat experiment and occupant responses N86-21939
Structural loads preliminary results N86-21940
Digital filtering and acceleration pulse interpretation N86-21941
Preliminary floor, seat, and dummy data N86-21942
Controlled impact demonstration airframe bending bridges N86-21943
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945
Controlled impact demonstration on-board (interior) photographic system N86-21946
CID-720 aircraft high-environment flight instrumentation system N86-21947
Impact dynamics instrumentation N86-21948
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
TRANSPORT PROPERTIES
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
Empirical equations for drift velocities in silicon
[AD-A162743] N86-21777
Study of mechanisms of ionic transport in crystalline and glassy solid electrolytes N86-21976
TRANSPORTATION
CWI Newsletter, no. 7, June 1985
[CWI-NEWSLETTER-7] N86-22121
Vehicle routing and computer graphics N86-22124
TRAPPED VORTEXES
Vortical flows about oscillating airfoil with surface suction N86-21502
TRAPPING
Enhancing efficiency of atom ionization by pulsed periodic lasers N86-22265
TRAVELING WAVE TUBES
Linearized traveling wave amplifier with hard limiter characteristics
[NASA-CASE-LEW-13981-2] N86-21742
TREES (MATHEMATICS)
Sequential decoding for multiple access channels
[AD-A162630] N86-21738
TRINITROTOLUENE
An eight-inch diameter, heavily confined card gap test
[AD-A161557] N86-21705
TROPOSPHERE
EPA (Environmental Protection Agency) oxidant model: Description and evaluation plan
[PB86-103090] N86-22016
TRUSSES
Dynamic characteristics of two 300 kW class dual keel space station concepts
[NASA-TM-87680] N86-21569
TUNABLE LASERS
Novel methods for tuning free electron lasers to multiple wavelengths
[AD-D011986] N86-21847
New findings on creation of powerful tunable subpicosecond solid-state lasers N86-22263
TUNGSTEN
High resolution photoemission investigation: The oxidation of W N86-22348
TUNGSTEN CARBIDES
Crack initiation and microstructure in tungsten carbide-cobalt composites N86-21651
TUNING
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Multi-Input/Multi-Output sensitivity points tuning
[AD-A161641] N86-22193
Tutorials on self-tuning control. Volume 1: Introduction to self-tuning and adaptive control
[OUEL-1592/85-VOL-1] N86-22196
Tutorials on self-tuning control. Volume 2: Automatic tuning of PID regulators
[OUEL-1593/85-VOL-2] N86-22197
Prediction of stochastic processes using self-tuning principles
[OUEL-1597/85] N86-22200
Oxidation of GaSs(110) cleaved surface N86-22345
Applications of tunable VUV radiation N86-22350
Deexcitation electron spectroscopy of free and coordinated CO N86-22363
Contact X-ray microscopy of biological materials N86-22370
TURBINE BLADES
The development of a heat transfer measurement technique for application to rotating turbine blades
[OUEL-1584/85] N86-21810
Damping properties of steam turbine blades N86-21890
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
TURBINE ENGINES
Multidimensional high-resolution gas chromatographic investigations of hydrocarbon fuels and various turbine engine fuel precursors
[AD-A162660] N86-21709
Damping applications in turbine engines N86-21888
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
TURBINE PUMPS
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
TURBINE WHEELS
The development of a heat transfer measurement technique for application to rotating turbine blades
[OUEL-1584/85] N86-21810
TURBOJET ENGINES
High frequency-heated air turbojet
[NASA-TM-77710] N86-21543
Dual material exhaust nozzle flap
[AD-D011998] N86-21548
TURBOMACHINERY
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
TURBULENCE
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519
Heat release effects in a turbulent, reacting shear layer N86-21788
Soliton turbulence
[NASA-CR-3969] N86-22056
Weather radar studies
[AD-A161622] N86-22061
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
TURBULENT BOUNDARY LAYER
Measurement of heat-transfer coefficients in shock wave-turbulent boundary layer interaction regions with a multi-layered thin film heat transfer gauge
[NASA-TM-77958] N86-21790
Studies of acoustic effects on a flow boundary layer in air
[NASA-TM-77981] N86-21792
Development of perturbations in the boundary layer
[NASA-TM-77986] N86-21793
TURBULENT FLOW
Vortex conception of rotor and mutual effect of screw/propellers
[NASA-TM-77979] N86-21510

Losses in channels with increased internal turbulence
[NASA-TM-77995] N86-21515
Semiempirical methods for computing turbulent flows
[NASA-TM-77996] N86-21795
Laminar boundary layer in conditions of natural transition to turbulent flow
[NASA-TM-77985] N86-21796
TURBULENT HEAT TRANSFER
Measurement of heat-transfer coefficients in shock wave-turbulent boundary layer interaction regions with a multi-layered thin film heat transfer gauge
[NASA-TM-77958] N86-21790
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
TURBULENT JETS
Experiments on entrainment, mixing and chemical reactions in turbulent jets at large Schmidt number N86-21503
TURBULENT MIXING
Coherent large-scale structures in high Reynolds number supersonic jets
[NASA-CR-3952] N86-22303
Aeroacoustics of contoured and solid/porous conical plug-nozzle supersonic jet flows
[NASA-CR-176645] N86-22308
TURBULENT WAKES
Two methods for viscous and inviscid free-wake analysis of helicopter rotors
[AD-A161513] N86-21521
TWO DIMENSIONAL BOUNDARY LAYER
Turbine vane external heat transfer. Volume 1: Analytical and experimental evaluation of surface heat transfer distributions with leading edge showerhead film cooling
[NASA-CR-174827] N86-21546
TWO PHASE FLOW
A diffuser heat transfer and erosion code
[AD-A162436] N86-21802
TYROSINE
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089

U

U.S.S.R.
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
U.S.S.R. SPACE PROGRAM
Contemporary achievements in astronautics: Salyut-7, the Vega Project and Spacelab
[NASA-TM-77712] N86-21563
ULTRASHORT PULSED LASERS
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses
[NASA-TM-77903] N86-21841
New findings on creation of powerful tunable subpicosecond solid-state lasers N86-22263
ULTRASONIC FLAW DETECTION
NDE of composite materials using ultrasound: Quantitative optical detection N86-21609
ULTRASONIC RADIATION
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307
ULTRASONIC TESTS
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044
ULTRASONICS
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828
ULTRAVIOLET ASTRONOMY
Optical, UV and X-ray observations of X-ray binaries N86-22473
ULTRAVIOLET LASERS
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21344
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320
ULTRAVIOLET RADIATION
X-ray lithography: Beamline U6 N86-22332
Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406
ULTRAVIOLET SPECTRA
Analysis of nitric oxide fluorescence bands from high latitude rocket observations of the thermospheric dayglow N86-22018
UNDERWATER ACOUSTICS
Experimental studies on cavitation inception in a submerged jet
[OUEL-1586/85] N86-21811
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
UNDERWATER ENGINEERING
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311
UNITED STATES
Quality assurance for the acid precipitation measurement program in the US
[PB86-107034] N86-22011
UNLOADING
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory
[AD-A161733] N86-21958
UNSTEADY FLOW
Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
Numerical simulation of vortex breakdown
[NASA-TM-77951] N86-21789
UPPER ATMOSPHERE
Middle infrared emission studies in the upper atmosphere by rocket techniques N86-22033
Experimental and theoretical information on radiative lifetimes and oscillator strengths --- aeronomy N86-22037
Spectroscopic, kinetic, and dynamic experiments on atmospheric species
[AD-A162691] N86-22050
A meridional circulation model to study upper atmosphere seasonal phenomena
[INPE-2716-PRE/852] N86-22058
Weather radar studies
[AD-A161622] N86-22061
URANIUM
Determination of Tri-n-Butyl Phosphate (TBP) in the TBP-mVarsol-HNO3 system using precision densimetry
[DE86-001607] N86-21832
URANIUM COMPOUNDS
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
URANIUM ISOTOPES
Fusion and fission studies for the system S-32 + U-238 N86-22404
URANIUM OXIDES
Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
URBAN PLANNING
Representation of urban districts in a geographical information system
[PB86-109451] N86-22455
USER MANUALS (COMPUTER PROGRAMS)
Integrated Composite Analyzer (ICAN): Users and programmers manual
[NASA-TP-2515] N86-21614
ASIM (Automated interactive simulation modeling system) VAX version user's manual
[AD-A161556] N86-22162
Minimization of a six variable boolean function
[AD-A161718] N86-22166
Development and use of the Life Cycle Cost In Design computer program (LCCID)
[AD-A162522] N86-22174
POLYGON: An interactive program for constructing and editing the geometries of polygons using a color graphics terminal
[DE86-001419] N86-22185
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
USER REQUIREMENTS
Software development: Science or patchwork N86-22119
Decision support system for ASD (Aeronatical Systems Division) program managers
[AD-A161690] N86-22137
View based, global design of access structures for relational databases N86-22144
Computer-Based Instruction (CBI): Considerations for a user-oriented technology data base
[AD-A161778] N86-22167
UTILIZATION
Ada reusability guidelines
[AD-A161259] N86-22157

V

VACUUM CHAMBERS
Photon desorption studies of synchrotron materials N86-22339
VALENCE
Photon energy dependent branching ratios of the inner valence satellites in the photoemission of solid ethylene N86-22336
Resonance valence-band photoemission and h Nu dependent 3p photoemission of MnF2 N86-22368
VALLEYS
Hadley Rille, lava tubes and mare volcanism at the Apollo 15 site N86-22516
VAN DER WAAL FORCES
Energy flow in van der Waals molecules N86-22361
VANADIUM
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344
VANADIUM COMPOUNDS
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
VANADIUM OXIDES
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
VAPOR DEPOSITION
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane
[AD-A162548] N86-22426
VAPOR PHASE EPITAXY
Diffusion and defect characterization studies of mercury cadmium telluride
[AD-A162644] N86-22429
VAPOR PHASES
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
Electrically excited phenomena in gas-phase devices
[AD-A161527] N86-21764
Applications of tunable VUV radiation N86-22350
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
Measurement of the dissociation energies of gas phase neutral dimers by a photoionization technique N86-22360
Gas phase spectroscopy in the soft X-ray region of the U15 beamline N86-22373
VAPORS
Coincidental chemical signature identifier
[AD-A161269] N86-21637
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases
[AD-A162766] N86-21695
VARIABILITY
Solar photospheric and coronal abundances from solar energetic particle measurements N86-22532
VARIABLE STARS
On the variability of Sigma Geminorum: An interesting candidate for X-ray studies --- binary star N86-22476
VARIATIONS
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
VARISTORS
Chemical preparation of high-field zinc oxide varistors
[DE86-001611] N86-21784
VECTOR ANALYSIS
An adaptive mesh algorithm for solving systems of time dependent partial differential equations
[AD-A161822] N86-22215
VELOCITY
Spectral imaging with a CID camera
[AD-A161608] N86-21824
VELOCITY MEASUREMENT
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712
VENEZUELA
The history of aeronautical medicine in Venezuela
[NASA-TM-77709] N86-22094
VENUS PROBES
Contemporary achievements in astronautics: Salyut-7, the Vega Project and Spacelab
[NASA-TM-77712] N86-21563
VERTICAL DISTRIBUTION
Vertical distribution of acetonitrile in the atmosphere
[AERONOMICA-ACTA-A-300-1985] N86-22021

VERTICAL FLIGHT
Vertically operating flight vehicle for drilling and agricultural use
[NASA-TM-77713] N86-21535
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115

VERTICAL LANDING
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115

VERTICAL TAKEOFF AIRCRAFT
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115

VERY LARGE SCALE INTEGRATION
Numerical model and analysis of transistors with polysilicon emitters N86-21750
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Reducing memory references via effective register usage
[AD-A161352] N86-21760
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits
[AD-A161371] N86-21761
Plane representations of graphs and visibility between parallel segments
[AD-A161689] N86-21770
A coherent VLSI design environment
[AD-A161743] N86-21771
Silicon compilation: A solution to the complexity of VLSI (Very Large-Scale Integrated) circuit design
[AD-A162564] N86-21774
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
Investigations of the etching chemistry of electronic materials N86-22347

VERY LOW FREQUENCIES
X-ray microbursts and VLF chorus
[AD-A162531] N86-22049

VIBRATION
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Quasi-modal vibration control by means of active control bearings
[NASA-TM-87232] N86-21856
Modified finite strip method with spline functions N86-21878

VIBRATION DAMPING
Limiting performance of nonlinear systems with applications to helicopter vibration control
[AD-A161457] N86-21551
Vibration Damping 1984 Workshop Proceedings
[AD-A152547] N86-21883
Some musings on how to make damping a creative force in design N86-21884
Damping applications in turbine engines N86-21888
Characteristics of dry friction damping N86-21889
Damping properties of steam turbine blades N86-21890
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
Friction damping studies at Imperial College N86-21893
Composite material damping using impulse technique N86-21895
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897
Improvement of damping in fiber reinforced polymer composites N86-21898
Damping in metal-matrix composites: Measurement and modeling N86-21901
Structural damping of shuttle orbiter and ascent vehicles N86-21904
Measured damping of shuttle acoustic test structures N86-21905
Structural damping potential of waveguide absorbers N86-21907
New proposed dynamic vibration absorbers for excited structures N86-21908
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
Finite element design of viscoelastically damped structures N86-21910
On vibration damping analysis using the finite element method N86-21911
Results of finite element analysis of damped structures N86-21912
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
Laminated damped fuselage structures N86-21916
Beam dampers for skin vibration and noise reduction in the 747 N86-21917
Use of skin damping treatments to control airframe dynamic response for interior noise control N86-21919
Damping application to spacecraft N86-21920
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921
Damping in support structures for satellite equipment reliability: RELSAT N86-21922
A design guide for damping of aerospace structures N86-21923
Distributed piezoelectric-polymer active vibration control of a cantilever beam N86-21924
Critical damping in complex structures and control systems N86-21927
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928

VIBRATION EFFECTS
Results of finite element analysis of damped structures N86-21912
The role of vibration and rattle in human response to helicopter noise
[AD-A162486] N86-22110

VIBRATION ISOLATORS
Experimental-theoretical study of velocity feedback damping of structural vibrations N86-21853
Concepts and effects of damping in isolators N86-21891
New proposed dynamic vibration absorbers for excited structures N86-21908
Vibration isolation of an elevator system N86-21914
Beam dampers for skin vibration and noise reduction in the 747 N86-21917
Damping application to spacecraft N86-21920
Passive and Active Control Of Space Structures (PACOSS) N86-21931

VIBRATION MEASUREMENT
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
Composite material damping using impulse technique N86-21895
Damping measurement by dynamic stiffness methods N86-21902
Damping application to spacecraft N86-21920

VIBRATION TESTS
Test fixture effects in vibration tests of rocket motors
[AD-A161403] N86-21581
Passively damped joints for advanced space structures N86-21930
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949

VIBRATIONAL SPECTRA
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses
[NASA-TM-77903] N86-21841
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038
Diagnosis of populations and relaxation processes of vibrational and rotational states of molecules in gases by coherent anti-Stokes scattering spectroscopy N86-22261

VIBRATORY LOADS
Concepts and effects of damping in isolators N86-21891
Average loss factors for use in statistical energy analysis N86-21906

VIDEO COMMUNICATION
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731

VIDEO EQUIPMENT
Emergency Management Computer-Aided Trainer (EMCAT)
[NASA-CR-178738] N86-21554
The RTJ1200 video amplifier. Investigation of low noise, low distortion amplifiers for low source impedance
[REPT-52/83/54] N86-21753
Reconfigurable work station for a video display unit and keyboard
[NASA-CASE-MFS-26009-1SB] N86-22114

VIDEO SIGNALS
Radar-clutter simulator
[AD-D011992] N86-21741
Spectral imaging with a CID camera
[AD-A161608] N86-21824
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015

VISCOELASTIC DAMPING
Fractional calculus to represent complex modulus N86-21885
Finite element design of viscoelastically damped structures N86-21910
On vibration damping analysis using the finite element method N86-21911
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
Integrated damped fuselage structure N86-21918
A design guide for damping of aerospace structures N86-21923
An experimental study of passive damping and active control of large space structures N86-21925
Critical damping in complex structures and control systems N86-21927

VISCOELASTICITY
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886
Improved extensional modulus measurements for polymers and metal matrix composites N86-21896
Improvement of damping in fiber reinforced polymer composites N86-21898
Structural damping potential of waveguide absorbers N86-21907

VISCOSITY
Complexes of nitrocellulose with cupric chloride
[AD-A162519] N86-21589
Fuel property effects on the unaided cold starting of a two-cycle diesel engine
[AD-A162658] N86-21708
Piezoviscous effects in nonconformal contacts lubricated hydrodynamically
[NASA-TM-87141] N86-21797

VISCOUS DAMPING
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21894
Sizing of discrete viscous dampers on a flexible body in the presence of a fixed controller N86-21926
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928
Passive and Active Control Of Space Structures (PACOSS) N86-21931

VISCOUS FLOW
A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508

VISCOUS FLUIDS
Viscous fluid motion in a spinning and nutating cylinder
[AD-A162686] N86-21804

VISIBILITY
Plane representations of graphs and visibility between parallel segments
[AD-A161689] N86-21770

VISIBLE SPECTRUM
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046

VISION
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
Edge detection
[AD-A162662] N86-22395

VISUAL FIELDS
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104

VISUAL PERCEPTION
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104
Visual perception in correlated noise N86-22106

VISUAL SIGNALS
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104

VOICE COMMUNICATION
Controlled impact demonstration flight data recorders/cockpit voice recorders N86-21944

VOIDS
Void initiation preceding ductile fracture in polycrystalline titanium
[AD-A161821] N86-21668
Gallium Arsenide structures and interfaces formed by molecular beam epitaxy N86-21747

VOLATILITY
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162528] N86-22006
VOLCANOLOGY
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Apollo 15 mare units and their petrogenesis N86-22512
Apollo 15 mare volcanism: Constraints and problems N86-22515
Hadley Rille, lava tubes and mare volcanism at the Apollo 15 site N86-22516
The Apennine Bench Formation revisited N86-22526
VORTEX BREAKDOWN
Numerical simulation of vortex breakdown
[NASA-TM-77951] N86-21789
VORTEX SHEETS
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
VORTICES
Vortex conception of rotor and mutual effect of screw/propellers
[NASA-TM-77979] N86-21510
Effect of a rotor wake on the local heat transfer on the forward half of a circular cylinder
[NASA-TM-87234] N86-21794
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
VOYAGER 2 SPACECRAFT
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531

W

WAFERS
Apparatus for edge etching of semiconductor wafers
[NASA-TM-77998] N86-21720
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765
Models for the oxidation of silicon
[AD-A161751] N86-22424
WALKING
Drop foot corrective device
[NASA-CASE-LAR-12259-2] N86-22112
WALL FLOW
Semiempirical methods for computing turbulent flows
[NASA-TM-77996] N86-21795
WALLS
Airblast loading of wall panels
[FOA-C-20586-D6] N86-21966
WASTE WATER
Freshwater wetlands for wastewater management environmental assessment handbook
[PB86-106564] N86-21975
WATER
Critical view of photochemical and photoelectrochemical methods for hydrogen production — solar energy N86-21992
Role of hydrogen in solar energy utilization: Problems and aspects of the hydrogen issue N86-21993
WATER CURRENTS
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073
Current celocity and hydrographic observations of the Straits of Florida: Subtropical Atlantic climate study (STACS) 1983 and 1984
[PB86-108602] N86-22079
WATER HEATING
Solar systems with highly efficient collectors N86-21988
WATER POLLUTION
Research projects of the Water Resources Research Institute during FY 1983
[PB86-101235] N86-21973
Freshwater wetlands for wastewater management environmental assessment handbook
[PB86-106564] N86-21975
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center — research reactor
[OEFZS-4324] N86-22008
Inventory of non-federally funded marine pollution research, development and monitoring activities: Great Lakes region
[PB86-102308] N86-22012
WATER QUALITY
Colorado Water Resources Research Institute activities report, FY 1981-1984
[PB86-101367] N86-21974
Inventory of non-federally funded marine pollution research, development and monitoring activities: Great Lakes region
[PB86-102308] N86-22012
Five year program strategy for Great Lakes National Program Office, 1986-1990
[PB86-107984] N86-22060
WATER RECLAMATION
Freshwater wetlands for wastewater management environmental assessment handbook
[PB86-106564] N86-21975
WATER RESOURCES
Research projects of the Water Resources Research Institute during FY 1983
[PB86-101235] N86-21973
Colorado Water Resources Research Institute activities report, FY 1981-1984
[PB86-101367] N86-21974
WAVE ATTENUATION
Damping in metal-matrix composites: Measurement and modeling N86-21901
WAVE EQUATIONS
Systematics of strongly self-dominant higher order differential equations based on the painleve analysis of their singularities
[AD-A162545] N86-22216
WAVE FRONT DEFORMATION
Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286
WAVE FRONTS
Universal wavefront sensor apparatus
[AD-D011983] N86-21830
Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
WAVE FUNCTIONS
Raman heterodyne interference phenomena N86-22391
WAVE GENERATION
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
WAVE INTERACTION
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
WAVE PROPAGATION
Data analysis of the NOAA-GIT (National Oceanic and Atmospheric Administration-Georgia Institute of Technology) millimeter-wave propagation experiment near Faltville, Illinois
[AD-A161722] N86-21733
The evolution of a wave train in a three-dimensional boundary layer
[FFA-TN-1985-54] N86-21809
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044
Diffraction efficiency of holographic gratings with symmetrical profiles N86-22283
Nonlinear acoustic wave propagation in atmosphere
[NASA-CR-176642] N86-22309
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
WAVE REFLECTION
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044
WAVE SCATTERING
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044
WAVEFORMS
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
WAVEGUIDES
Effects of waveguide modes on the scattering of a finite tubular cylinder
[AD-A161500] N86-21729
Investigation of planar waveguides and components for millimeter-wave integrated circuits
[AD-A161400] N86-21763
Structural damping potential of waveguide absorbers N86-21907
Diffraction efficiency of holographic gratings with symmetrical profiles N86-22283
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299
WAVELENGTHS
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths
[AD-A162753] N86-21824
Time and frequency dependent behavior of a two dimensional electron gas at long wavelengths
[AD-A162546] N86-21773
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052
Wavelength switching in copper-vapor lasers N86-22275
WEAPON SYSTEMS
The evolution of the cruise missile
[AD-A162646] N86-21538
WEATHER
Weather radar studies
[AD-A161622] N86-22061
WEATHER FORECASTING
Mariners Weather Log, Volume 29, Number 3: Summer, 1985
[PB86-108313] N86-22068
WEATHER MODIFICATION
Nuclear winter: Smoke generation, deposition, and removal
[AD-A161807] N86-22004
WEATHER STATIONS
User's guide for the multiple airshed (MASH) model
[PB86-100146] N86-22014
WEIGHT REDUCTION
Lightweight nickel electrode for nickel hydrogen cells and batteries
[NASA-TM-87253] N86-21978
WEIGHTING FUNCTIONS
An evaluation of study design for estimating a time-of-day noise weighting
[NASA-CR-178062] N86-22306
WEIGHTLESSNESS
Some musings on how to make damping a creative force in design N86-21884
WEIGHTLESSNESS SIMULATION
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560
WELD STRENGTH
Estimation of the high temperature low cycle fatigue strength of welded joints. 1: Proposal of fundamental estimation methods
[BLL-RISLEY-TR-5236-(9091.9F)] N86-21876
Evalution of low cycle fatigue strength of welded joints at elevated temperature: Applicability of methods of evaluation and plastic restraint
[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877
WELDABILITY
Improvements in the weldability of a superconductor sheath material
[DE86-000748] N86-21867
WELDED JOINTS
Automated weld torch guidance control system
[NASA-CASE-MFS-25807-2] N86-21850
Estimation of the high temperature low cycle fatigue strength of welded joints. 1: Proposal of fundamental estimation methods
[BLL-RISLEY-TR-5236-(9091.9F)] N86-21876
Evalution of low cycle fatigue strength of welded joints at elevated temperature: Applicability of methods of evaluation and plastic restraint
[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877
WELDING
Structural evaluation of superplastic aluminum. Part 1. Mechanical, corrosion, metallurgical data
[AD-A161366] N86-21662
WHISKER COMPOSITES
Fatigue response of silicon carbide whisker/aluminum matrix composites N86-21591
WHITE NOISE
On stochastical integration by series of Wiener integrals
[AD-A161514] N86-22211

WIDEBAND COMMUNICATION
Development of improved broadband cable system communications
[AD-A161559] N86-21766
WIGGLER MAGNETS
Influence of electromagnetic wave and wiggler fields inhomogeneity on a free-electron laser N86-22264
Undulator based beamline studies on U5 N86-22331
WIND (METEOROLOGY)
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study
[AD-A162768] N86-22052
Studies of complex-terrain flows using acoustic remote sensors
[PB86-100138] N86-22068
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073
Wind driven ocean modeling and ocean model development
[AD-A161742] N86-22074
WIND EFFECTS
Algorithms for the automatic four-dimensional guidance of aircraft, taking into account the current wind situation
[ESA-TT-908] N86-21531
WIND PROFILES
Analysis of Jimsphere pairs for use in assessing Space Vehicle ascent capability
[NASA-TP-2573] N86-21506
WIND SHEAR
Analysis of Jimsphere pairs for use in assessing Space Vehicle ascent capability
[NASA-TP-2573] N86-21506
Weather radar studies
[AD-A161622] N86-22061
WIND TUNNEL APPARATUS
Flow field measurements in the 3mx3m low speed wind tunnel of the DFVLR in Goettingen (West Germany)
[DFVLR-MITT-85-14] N86-21558
WIND TUNNEL TESTS
Investigation of solid plume simulation criteria to produce flight plume effects on multibody configuration in wind tunnel tests
[NASA-TP-2569] N86-21507
Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514
A new method for laminar boundary layer transition visualization in flight: Color changes in liquid crystal coatings
[NASA-TM-87666] N86-21518
Flow field measurements in the 3mx3m low speed wind tunnel of the DFVLR in Goettingen (West Germany)
[DFVLR-MITT-85-14] N86-21558
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443
WIND VARIATIONS
Analysis of Jimsphere pairs for use in assessing Space Vehicle ascent capability
[NASA-TP-2573] N86-21506
WING OSCILLATIONS
Theory of wing rock
[NASA-CR-176640] N86-21520
WING PLANFORMS
Equivalent plate analysis of aircraft wing box structures with general planform geometry
[NASA-TM-87697] N86-21954
WING PROFILES
Procedure for utilizing the lift and thrust forces of ornithopters
[NASA-TM-77682] N86-21534
Effects of wing modification on an aircraft's aerodynamic parameters as determined from flight data
[NASA-TM-87591] N86-21550
WINTER
Nuclear winter: Smoke generation, deposition, and removal
[AD-A161807] N86-22004
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109
WIRE
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Electrical cone connector
[AD-D011982] N86-21781
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899
WIRE CLOTH
Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765
WORDS (LANGUAGE)
Attention within auditory word perception
[AD-A162550] N86-22111
WORK FUNCTIONS
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428
WORKSTATIONS
Reconfigurable work station for a video display unit and keyboard
[NASA-CASE-MFS-26009-1SB] N86-22114
WOUND HEALING
Development of an ultrafast-curing wound dressing
[AD-A162471] N86-22099

X

X RAY ABSORPTION
Fragmentation of small molecules following soft X-ray absorption near the carbon K-edge N86-22333
Surface sensitive photoemission EXAFS: A new structural tool N86-22364
X RAY APPARATUS
High sensitivity, one-sided X-ray inspection system
[AD-A162567] N86-21875
X RAY ASTRONOMY
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461
Capabilities of spectroscopy in the context of X-ray astronomy in the 1900's --- spaceborne astronomy N86-22462
The X-ray background --- galactic radiation N86-22463
The X-ray spectroscopy of active galactic nuclei N86-22464
High resolution X-ray spectroscopy of clusters of galaxies --- spaceborne astronomy N86-22465
Stellar activity: The X-ray picture --- spaceborne astronomy N86-22469
The X-ray spectroscopic study of the interstellar medium N86-22470
Instrumentation for X-ray spectroscopy --- spaceborne astronomy N86-22471
Optical, UV and X-ray observations of X-ray binaries N86-22473
Nonionization equilibrium effects in the supernova remnant (SNR) RCW 86 --- X ray astronomy N86-22474
On the variability of Sigma Geminorum: An interesting candidate for X-ray studies --- binary star N86-22476
Soft X-ray maps of the Large Magellanic Cloud (LMC) N86-22480
EXOSAT observations of the poor cluster of galaxies 2A0335+096 N86-22484
Dispersive X-ray spectroscopy with transmission gratings --- X ray astronomy N86-22492
The XMM imaging Bragg spectrometer with a doubly curved crystal N86-22493
Bolometers as spectrometers for X-ray astronomy N86-22496
Room temperature solid state spectrometer for X-ray astronomy N86-22497
The application of reflection gratings to a large area X-ray spectroscopy mission: A discussion of scientific requirements and various design options --- spaceborne astronomy N86-22498
A multiwire proportional counter for low energy X-ray imaging --- X ray astronomy N86-22499
X-ray polarimetry on XMM --- spaceborne X ray astronomy N86-22500
A multiplex coding imaging spectrometer for X-ray astronomy N86-22501
Objective crystal spectrometer (OXS) for imaging extended cosmic X-ray sources N86-22502
The Penning gas imager in a space application --- X ray astronomy N86-22503
X-ray applications of deep-depletion CCDs --- astronomy N86-22504
X-ray imaging spectroscopy with CCDs --- X ray astronomy N86-22505
X RAY BINARIES
Accreting neutron stars in close binary systems N86-22468
Optical, UV and X-ray observations of X-ray binaries N86-22473
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483
X RAY FLUORESCENCE
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483
X RAY IMAGERY
Contact X-ray microscopy of biological materials N86-22370
X-ray holography experiments on the U15 beam line N86-22371
Scanning soft X-ray microscopy on the U15 beam line N86-22372
X RAY INSPECTION
High sensitivity, one-sided X-ray inspection system
[AD-A162567] N86-21875
X RAY SCATTERING
High sensitivity, one-sided X-ray inspection system
[AD-A162567] N86-21875
Measurements of intrinsic width and mosaicity of test crystals with a novel four-crystal X-ray spectrometer --- spaceborne astronomy N86-22494
Measurements of surface scattering from mirrored surfaces using a triple axis X-ray spectrometer --- X ray telescope development N86-22495
X RAY SOURCES
Deexcitation electron spectroscopy of free and coordinated CO N86-22363
EXOSAT CMA observations of X0512-401 = NGC 1851 --- X ray source N86-22477
Objective crystal spectrometer (OXS) for imaging extended cosmic X-ray sources N86-22502
X RAY SPECTRA
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
The X-ray background --- galactic radiation N86-22463
The X-ray properties of normal galaxies. What do we know and what can we learn with the next generation of X-ray telescopes? --- spaceborne telescope N86-22466
The X-ray spectroscopy of supernova remnants N86-22467
The X-ray spectrum of emission line stars (superluminous and symbiotic) N86-22472
Nonionization equilibrium effects in the supernova remnant (SNR) RCW 86 --- X ray astronomy N86-22474
The X-ray spectra of bursting neutron stars: Effects of Comptonization and bound-free opacity N86-22475
Interpretation of the oxygen 7 soft X-ray spectrum from the Puppis-A supernova remnant N86-22481
The X-ray spectra and the rotation-activity connection of RS CVN binaries N86-22482
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483
Long-term X-ray variability in the Hyades cluster N86-22486
X RAY SPECTROSCOPY
Relative intensity-energy calibration of X-ray photoelectron spectrometers: Instructions for the use of reference materials SCAA83
[NPL-DMA(A)-97] N86-21813
Capabilities of spectroscopy in the context of X-ray astronomy in the 1900's --- spaceborne astronomy N86-22462
The X-ray spectroscopy of active galactic nuclei N86-22464
High resolution X-ray spectroscopy of clusters of galaxies --- spaceborne astronomy N86-22465
The X-ray properties of normal galaxies. What do we know and what can we learn with the next generation of X-ray telescopes? --- spaceborne telescope N86-22466
The X-ray spectroscopy of supernova remnants N86-22467
The X-ray spectroscopic study of the interstellar medium N86-22470
Instrumentation for X-ray spectroscopy --- spaceborne astronomy N86-22471
The Hyades: EXOSAT broad band spectroscopy --- star cluster N86-22485
The LAMAR telescope module for high throughput imaging and spectroscopy --- Large Area Modular Array of Reflectors (LAMAR) N86-22488
Dispersive X-ray spectroscopy with transmission gratings --- X ray astronomy N86-22492
The application of reflection gratings to a large area X-ray spectroscopy mission: A discussion of scientific requirements and various design options --- spaceborne astronomy N86-22498
A multiwire proportional counter for low energy X-ray imaging --- X ray astronomy N86-22499
A multiplex coding imaging spectrometer for X-ray astronomy N86-22501
X-ray applications of deep-depletion CCDs --- astronomy N86-22504
X-ray imaging spectroscopy with CCDs --- X ray astronomy N86-22505
X RAY TELESCOPES
Multispectral glancing incidence X-ray telescope
[NASA-CASE-MFS-28013-1] N86-22459
Proceedings of an ESA Workshop on a Cosmic X-Ray Spectroscopy Mission
[ESA-SP-239] N86-22461

The X-ray properties of normal galaxies. What do we know and what can we learn with the next generation of X-ray telescopes? --- spaceborne telescope N86-22466
Light weight aluminum optics --- spaceborne x-ray astronomy applications N86-22487
A thin foil high throughput X-ray telescope N86-22489
Carbon-fiber reinforced epoxy techniques for the X-ray Multimirror Mission (XMM) Low-Energy (LE) telescopes N86-22490
Electroform replication of grazing incidence X-ray optics --- spaceborne telescopes N86-22491
Measurements of intrinsic width and mosaicity of test crystals with a novel four-crystal X-ray spectrometer --- spaceborne astronomy N86-22494
Measurements of surface scattering from mirrored surfaces using a triple axis X-ray spectrometer --- X ray telescope development N86-22495

X RAYS
X-ray microbursts and VLF chorus [AD-A162531] N86-22049
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
Activity of the National Synchrotron Light Source (NSLS) [BNL-51840] N86-22326
Gas phase spectroscopy in the soft X-ray region of the U15 beamline N86-22373

XENON CHLORIDE LASERS
Lasing of XeCl, Xe and KrF excimer moleucles in two-comonent mistures N86-22269

XENON FLUORIDE LASERS
Lasing of XeCl, Xe and KrF excimer moleucles in two-comonent mistures N86-22269
Comparative analysis of optically and electronically pumped broadband excimer lasers N86-22273

Y

YAG LASERS
Generation of picosecond pulses in monopulse-pumped dye lasers N86-22271
YAG:Er3+ cross-relaxation laser N86-22277
Investigation of fluorescence kinetics of dyes by parametric frequency conversion N86-22289

YEAST
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content [AD-A161811] N86-22083

YIELD
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content [AD-A161811] N86-22083

YTTRIUM-IRON GARNET
Using the nuclear gamma resonance method to study radiation defects in ferrites [BLL-CE-TRANS-8220-(9022.090)] N86-22415

Z

ZINC OXIDES
Chemical preparation of high-field zinc oxide varistors [DE86-001611] N86-21784

ZINC SELENIDES
Excited-state properties of semiconductor electrodes and their application to optical energy conversion [AD-A162774] N86-22432

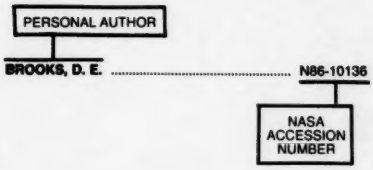
ZINC-CHLORINE BATTERIES
Utility cycle testing of a 500-kWh zinc chloride battery at the Battery Energy Storage Test (BEST) Facility [DE86-001598] N86-22002

ZIRCONIUM
Investigation of chemical durability mechanism in fluoride glasses [AD-A162740] N86-21693

ZIRCONIUM ALLOYS
Performance testing of refractory alloy-clad fuel elements for space reactors [DE85-018209] N86-22379

ZIRCONIUM OXIDES
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide [AD-A162694] N86-21645

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABALTUSOV, Y. Y. N86-21633
ABASHIAN, A. N86-22388
ABEN, K. K. N86-22284
ABEYOUNIS, W. K. N86-21514
ABRAHAM, M. M. N86-21959
ABRAHAMSON, A. L. N86-21953
ABRAMS, M. J. N86-21970
ACKERMAN, R. A. N86-21872
ACTON, L. W. N86-22481
ADAMS, G. W. N86-22052
ADAMS, N. G. N86-22043
ADAMS, S. D. N86-21961
ADATI, K. N86-22403
ADDLEMAN, D. R. N86-22178
ADLER, R. J. N86-22240
ADZIC, R. N86-21641
AFANASYEV, G. T. N86-21703
AFIFY, E. M. N86-21861
AGIN, G. J. N86-21863
AHAD, E. N86-21589
AHUJA, K. K. N86-22303
AKASOFU, S. I. N86-22535
ALBERS, W. N86-22122
ALEXANDER, K. E. N86-21688
ALFARO-BOU, E. N86-21936
N86-21940
ALFVEN, H. N86-22531
ALGERMISSEN, J. N86-21791
ALLGAIER, H. J. N86-22450
ALLTOP, W. O. N86-22394
ALLWINE, K. J. N86-22013
ALPER, J. M. N86-21621
ALTAMORE, A. N86-22472
AMORY, R. L. N86-21615
AMOS, N. A. N86-22324
ANDERSON, C. W. N86-21899
ANDERSON, S. L. N86-22367
ANDERSON, T. W. N86-22234
ANDERSSON, A. N86-22455
ANDO, T. N86-21664
ANDREEV, S. V. N86-22285
ANDREEVA, R. I. N86-22257
ANGELL, G. R. N86-21959
ANTCZAK, T. N86-22130
ANTEPENKO, R. J. N86-21702
ANTHONY, M. T. N86-21813
ANTONIADIS, D. A. N86-22181
AOKI, T. N86-22403
APOLLONOV, V. V. N86-22270
ARCHITETTO, P. N86-22451
ARIJS, E. N86-22021
ARIKAN, E. N86-21738
ARMANIOS, E. A. N86-21622
ARMSTRONG, L. E. N86-22102
ARMSTRONG, R. A. N86-22050
ARNESEN, T. N86-21562
ARNEY, D. C. N86-22215
ARNOLD, F. E. N86-21676
ARNONE, R. N86-22075
ARONHIME, M. T. N86-21691
ARONOWICH, M. N86-22240
ARONSSON, M. N86-22508
ARTZNER, G. N86-22496
ARYA, S. P. S. N86-22015
ASH, R. L. N86-21557
N86-21816
ASINOVSKIY, E. I. N86-22405
ASO, S. N86-21790
AUERBACH, C. N86-21835
AUGENSTEIN, B. W. N86-22434
AUSNIT, C. N86-22157
AUSTIN, C. F. N86-21999
AUSTIN, E. M. N86-21910
AVERY, W. B. N86-21599
AXNAES, I. N86-22413
N86-22531

B

BABER, R. L. N86-22119
BABIKOV, Y. F. N86-22415
BAGRAMYAN, A. R. N86-21633
BAILEY, F. A. N86-21574
BAILEY, J. W. N86-21858
BAILEY, T. N86-21924
BAILEY, W. F. N86-22408
BAIRAMOV, R. N86-21977
BAKER, D. R. N86-22403
BAKIS, C. E. N86-21610
BALDWIN, E. N86-22343
BALEBANOV, V. M. N86-21563
BALLARD, J. A. N86-22077
BALYKIN, V. I. N86-22282
BARASH, M. M. N86-21862
BARATTA, G. B. N86-22472
BARBER, R. N86-21935
BARDAKOVSKIY, S. V. N86-22267
BARKER, R. E., JR. N86-21694
N86-21695
BARNES, A. N86-22173
BARTH, J. N86-22365
BASKARAN, S. N86-21959
BASOV, N. G. N86-22261
BASS, T. L. N86-22436
BASU, A. N86-22511
BATDORF, S. B. N86-21620
BATISTA, P. P. N86-22030
BATOZ, J. L. N86-21964
BATTERSON, J. G. N86-21549
BAUER, E. N86-22004
BAUER, H. F. N86-21908
BAZILEVSKIY, A. T. N86-22507
BEARDS, C. F. N86-21893
BEAUCHAMP, E. K. N86-21698
N86-21959
BECK, C. J. N86-21921
BEDFORD, D. N86-22491
BEESE, L. N86-22370
BEKKER, P. A. N86-22225
BELENOV, E. M. N86-22299
BELOV, I. A. N86-21795
BELY-DUBAU, F. N86-22481
BELYAYEV, V. P. N86-22272
BEMENT, L. J. N86-21858
BENBROOK, J. R. N86-22049
BENESCH, W. N86-22038
BENNETT, T. J., JR. N86-22062
BENNETTE, D. D. N86-21604
BENSON, A. N86-22130
BEREZHINSKIY, L. I. N86-22256
BERGER, H. N86-21875
BERING, E. A. N86-22049
BERKOWITZ, B. N86-22168
BERSOHN, R. N86-22354
N86-22355
BESUNER, P. M. N86-21961
BETHKE, K. H. N86-21727
BEUGELSDIJK, T. N86-21868
BEZARD, C. N86-21534
BHARADVAJ, B. N86-21521
BHASIN, K. B. N86-21757
BHUTTA, B. A. N86-21501
BIANCHI, L. N86-22473
BIELAK, J. N86-21892
BILARDI, G. N86-21758
N86-21767
BILHORN, R. B. N86-22406
BINDER, A. A. N86-22512
BINDER, M. N86-21647
BIRK, S. N86-22006
BLACK, W. M. N86-21845
BLACKSTEN, H. R. N86-22169
BLADIMIROVA, N. M. N86-22267
BLAKEMAN, E. D. N86-22378
BLEEKER, J. A. M. N86-22492
BLOCK, D. H. N86-21973
BLUM, L. N86-21776
BOBER, L. J. N86-21517
BOCHAROV, V. K. N86-22296
BOERIO, F. J. N86-21584
BOERSCH, B. N86-21756
BOGARD, D. D. N86-22513
BOGATOV, A. P. N86-22274
BOGUS, K. N86-21996
BOHN, W. L. N86-22414
BOLAND, P. J. N86-22182
BOMELBURG, H. J. N86-22003
BONATSOS, D. N86-22374
BONING, D. S. N86-22181
BOTTS, L. N86-22080
BOVE, L. J. N86-22005
N86-22006
BOVINA, T. A. N86-21632
BOVINO, L. J. N86-21780
BOWHILL, S. A. N86-22534
BOX, G. E. P. N86-22244
BOYD, J. K. N86-22385
N86-22387
BRABBS, T. A. N86-21635
BRADLEY, R. C. N86-22223
BRADY, W. E. N86-22236
BRANDMAYR, R. J. N86-21722
BRANDUARDI-RAYMONT, G. N86-22477
BRAU, J. E. N86-22381
BRAUN, C. N86-22157
BRECHT, S. H. N86-22376
BREED, C. S. N86-21971
BRENCHLEY, D. L. N86-22003
BRENEMAN, H. H. N86-22532
BRENNING, N. N86-22413
N86-22531
BRETZLAFF, R. S. N86-21690
BREWE, D. E. N86-21797
BREYZMAN, B. N. N86-22293
BRINKMAN, A. C. N86-22492
BRINSON, H. F. N86-21602
BRITTON, D. L. N86-21978
BROCKMAN, R. A. N86-21911
BROTHERTON, T. W. N86-22137
BROWN, K. T. N86-21906
BROWN, R. N86-21827
BROWN, W. H. N86-22303
BROYTMAN, A. P. N86-22298
BUCKLEY, D. H. N86-21575
BUGG, W. M. N86-22381
BURD, H. J. N86-22227
N86-22228
BURKE, W. R. N86-21983
BURKHARD, N. R. N86-22053
BURKHARDT, C. E. N86-22349
BURKITT, D. N86-22006
BURNS, D. W. N86-21888
BURNS, M. R., JR. N86-21850
BURRIN, R. H. N86-22303
BURROWS, D. N. N86-22480
BUTLER, J. C. N86-22514
BUTRYMOWICZ, D. B. N86-21666
BUTZEL, L. M. N86-21918
BUZZARD, G. H. N86-21802
BYRNAK, B. N86-22493
N86-22502

C

CAHN, J. W. N86-21666
CALAHAN, D. A. N86-22190
CALDWELL, C. D. N86-22358
CALDWELL, S. J. N86-21697
CALEDONIA, G. E. N86-22318
CALKINS, M. E., JR. N86-22315
CALLOWAY, R. S. N86-21947
CALZAFERRI, G. N86-21991
CAMBANIS, S. N86-22210
CAMPBELL, W. H., JR. N86-21580
CANNON, J. E. N86-22001
CANNON, M. R. N86-21942
CANTIN, G. N86-21964
CANTRELL, J. H., JR. N86-22307
CANUTO, C. N86-22204
CAPORASO, G. J. N86-22385
N86-22387
CAPSIMALIS, G. P. N86-21671
CAPUTO, A. J. N86-21674
CARBONARO, M. N86-21837
CARDEN, H. D. N86-21603
CARLSON, E. N86-22453
N86-22454
CARLSSON, L. A. N86-21618
CARR, M. J. N86-21698
CARR, R. G. N86-22333
N86-22343
CARRERAS N86-22506
CARROLL, R. J. N86-22246
CARTER, J. M. N86-21702
CARTER, J. T. N86-21663
CARTER, R. A. N86-22107
CARTER, W. C. N86-21701
CASAJUS, A. N86-21720
CASENTI, B. N. N86-21889
CASSATELLA, A. N86-22472
CASTENEDA, P. P. N86-21689
CASTLEMAN, A. W., JR. N86-21638
CATON, G. M. N86-22007
CATURA, R. C. N86-22487
N86-22504
CAUDY, D. W. N86-21688
CAULFIELD, H. J. N86-22187
CAVITT, L. D. N86-22165
CEBALLOS, D. C. N86-21572
CHAMIS, C. C. N86-21614
CHANAN, G. N86-22500
CHANDRASHEKHARA, K. N86-21596
CHANG, J. F. N86-22188
CHATTERJEE, B. K. N86-21645
CHATURVEDI, S. K. N86-21895
CHAU, H. N86-21712
CHAUG, Y. S. N86-22369
CHEBURKIN, N. V. N86-22267
CHEN, C. T. N86-22363
CHEN, D. Y. N86-21694
CHEN, E. S. N86-21671
CHEN, J. N86-22045
CHEN, J. C. N86-21903
CHEN, J. L. N86-21878
CHEN, P. C. T. N86-21958
CHEN, T. S. N86-21582
N86-21590
CHEN, W. C. N86-22417
CHEN, Y. N86-21801
CHENG, C. H. N86-21582
CHENG, H. N86-21747
CHENG, H. Y. N86-21746
CHENG, Y. T. N86-21875
CHENKUO, T. N86-21710
CHEONG, H. N86-21760
CHERNOMORETS, M. P. N86-22269
CHIBA, K. N86-21628
N86-21629
CHICHUNG, L. N86-21710
CHIU, C. S. N86-21502
CHO, T. N86-21504
CHOU, W. N86-22189
CHOUDHARY, K. M. N86-22364
CHOW, C. K. N86-22243
CHRISTENSEN, E. L. N86-22102
CHRISTENSEN, F. E. N86-22493
N86-22494
N86-22495
CHUCHEL, B. A. N86-22185
CHUDETSKIY, Y. V. N86-21632
CHUNG, G. P. N86-21729
CHURSIN, A. D. N86-22272
CINOTTI, F. N86-22372
CITRIN, P. N86-22337
N86-22338
CLAAS, J. J. N86-22474
CLARKE, D. W. N86-22196
N86-22197
CLARKSON, B. L. N86-21906
CLAUS, R. O. N86-21604
CLEARY, D. D. N86-22018
CLEMENTS, F. N86-21731
CLIFFORD, S. F. N86-21733
CLODFELTER, R. G. N86-21528
CODENOTTI, B. N86-21759
COHEN, A. M. N86-22117
N86-22121
N86-22154
COHEN, D. N86-21598
COHEN, L. N86-22488
COLE, A. G. N86-22385
N86-22387
COLE, J. T. N86-21874
COLSON, W. B. N86-21847
COMPTON, E. C. N86-21660
CONBOY, J. N86-22029
N86-22041
CONDO, G. T. N86-22381
CONEL, J. E. N86-21970
COOK, M. V. N86-21533
COOMBS, M. G. N86-21870
COONEY, C. N86-22092
COOPER, D. E. N86-21598
COOPER, P. A. N86-21569
CORCUFF, P. N86-22020
CORCUFF, Y. N86-22020
CORDERMAN, R. N86-22339
COREY, R. N86-22349
CORON, N. N86-22496
COWELL, L. H. N86-21545
COX, B. H. N86-21547
COX, B. N. N86-21963
COX, C. M. N86-22379
CRAIG, B. G. N86-21705
CRANE, R. L. N86-21625
CRAWLEY, E. F. N86-21887
CRIMP, M. N86-21656
CRISCUOLO, E. L. N86-21875
CROOM, C. C. N86-21518
CUDDIHY, E. F. N86-21584
N86-21980
CULHANE, J. L. N86-22462
N86-22504
CUNNINGHAM, J. N86-21687
CUNNINGHAM, P. T. N86-22409
CURELARU, I. M. N86-22365
N86-22366
CUTTS, D. G. N86-21889

D

DAHL, S. R. N86-21894
DAHM, W. J. A. N86-21503
DALRYMPLE, R. H. N86-21621
DALTON, E. C. N86-21928
DAMATO, E. N86-21837
DAMBIER, G. N86-22496
DAME, L. T. N86-21952
DANESHVAR, K. N86-22460
DANG, L. D. N86-21579
DANIEL, R. N86-22198
DANILENKO, M. V. N86-22299
DANILYCHEV, V. A. N86-22261
DARA, P. H. N86-21600
N86-21619
DARYABEIGI, K. N86-21557
DAS-GUPTA, D. K. N86-21826
DAS, A. N86-21929
DAS, I. S. N86-22308
DATTA, S. K. N86-21901
DAUD, T. N86-21981
DAULTON, T. N86-22349
DAVIES, P. N86-21624
DAVIS, C. W. N86-21938
DAVIS, M. J. N86-22178
DAVIS, R. F. N86-21955
DEAMER, D. N86-22082
DEARAUJO, B. F. N86-21832
DEARAUJO, J. A. N86-21832
DEHMER, J. L. N86-21834
DEIS, B. C. N86-22112
DEJONGE, A. K. N86-21716
DEKORTE, P. A. J. N86-22490
DELANO, J. W. N86-22515
DELOACH, R. N86-22304
N86-22305
DELUCA, J. P. N86-22102
DEMENTYEV, A. S. N86-22288
DEMIR, O. N86-22316
DEMMEL, J. N86-22064
DENBOER, M. L. N86-22364
N86-22369
DENG, G. N86-21522
DENTON, M. B. N86-21829
N86-22320
N86-22406
DEOBALD, L. R. N86-21898
DERIAN, E. J. N86-21603
DERKACH, V. E. N86-22299
DESCHAMPS, J. Y. N86-22496
N86-22501
DESILVA, C. W. N86-21865
DEVILBISS, T. A. N86-21612
DEVRIES, J. N86-22118
DEVYATOV, A. A. N86-22279
DHEANDHANOO, S. N86-21645
DICOCCO, G. N86-22497
DIDIO, R. A. N86-22363
DIJKSTRA, J. H. N86-22492
DILL, C. C. N86-21507
DILLARD, D. A. N86-21602
DIN, K. S. N86-22365
N86-22366
DJERASSI, S. N86-21568
DMITRIEVA, L. A. N86-22283
DODGE, W. G. N86-21593
DODSWORTH, E. S. N86-22317
DOERSCHUK, P. C. N86-22105
N86-22220
DOLE, S. L. N86-21573
DOLENKO, S. A. N86-22279
DOMARKENE, D. P. N86-22288
DONALDSON, J. L. N86-22304
N86-22305
DONCHAK, V. A. N86-21583
DONNELL, B. P. N86-22073
DOORLY, J. E. N86-21810
DORAN, S. H. N86-21728
DORN, H. C. N86-21704
DORSEY, J. T. N86-21569
DOSANJH, D. S. N86-22308
DOSCH, R. G. N86-21784
DOSS, K. G. R. N86-22384
DOUGHTY, K. N86-21826
DOUGLAS, W. E. N86-21692
DOVGAL, A. V. N86-21793
DOWNIE, N. N86-21753
DRAKE, B. N86-21819
DRAKE, M. L. N86-21915
N86-21923
DRISCOLL, E. C., JR. N86-21967
DU, S. Y. N86-22417
DUKE, C. J., JR. N86-21609
DUKE, G. L. N86-21772
DUMIN, D. J. N86-22430
DUPUIS, M. N86-22322
DUQUETTE, D. J. N86-21670
DURBIN, W. F. N86-21999
DUSAUTOY, A. R. N86-21814
DUSI, W. N86-22497
DUTRA, S. L. G. N86-22025
DUTT, D. S. N86-22379
DYKSTRA, R. N86-22242
DYMEK, M. S. N86-22125

E

EANES, S. N86-22157
EARSOM, D. N86-22349
EBERGEN, J. C. N86-22121
N86-22154
EBERHARDT, W. N86-22333
N86-22334
N86-22335
N86-22336
N86-22343
N86-22363
EBISUZAKI, T. N86-22475
EDMONDS, P. H. N86-22410
EHRLICH, W. N86-21756
EICHENAUER, W. N86-21655
EICHMANN, G. N86-22393
EICKEMEYER, R. J. N86-22140
EKLUND, T. I. N86-21529
EL-NEWEIHI, E. N86-22135
ELGAROEY, O. N86-22476
ELIEL, E. L. N86-21587
ELKINS, R. H. N86-21874
ELLIOTT, R. A. N86-21849
ELLIS, A. B. N86-22432
ELSNER, L. N86-22253
ELY, R. A. N86-21916
EMRE, E. N86-22194
ENGLAND, A. C. N86-22410
ENGLEHART, M. N86-21578
ENGLISH, R. E. N86-21577
ENGVOLD, O. N86-22476
ENTRIKIN, D. M. N86-22065

ERCAN, E. N. N86-22477
ERICKSON, M. A. N86-21668
ESENDEMIR, A. N86-22477
ETHRIDGE, E. C. N86-21684
N86-21718
EVANS, D. F. N86-21639
EVANS, J. E. N86-22061

F

FABBIANO, G. N86-22466
FABELINSKIY, V. I. N86-22281
FABRICANT, D. N86-22488
FABRICK, A. J. N86-22016
FABY, D. R. N86-21857
FAGG, M. F. N86-22114
FAHEY, P. M. N86-21743
FAIRES, L. M. N86-22409
FANINGER, G. N86-21997
FARINACCI, M. L. N86-22176
FARRINGTON, S. M. N86-21826
FASANELLA, E. L. N86-21939
FAUCHER, P. N86-22481
FAYNBOYM, Y. G. N86-22274
FEDER, R. N86-22370
FEDOR, O. H. N86-22452
FEDOROV, V. B. N86-22290
FEDOROVA, V. A. N86-21583
FEINGOLD, E. N86-22451
FERNANCEZ, P. F. N86-22361
FERNANDEZ, P. F. N86-22360
FERREIRA, D. L. N86-21571
FESHCHENKO, V. P. N86-21841
FIELDS, J. M. N86-22306
FIENNING, W. C. N86-21574
FINKE, W. N86-21561
FINKELSTEIN, P. L. N86-22011
FIRSOV, K. N. N86-22270
FISHER, D. N86-22191
FISHER, D. M. N86-21661
FITZGERALD, T. E. N86-22010
FLAGAN, R. C. N86-22017
FLEETER, S. N86-21513
FLEMING, D. P. N86-21856
FLIFLET, A. W. N86-21845
FOBES, J. L. N86-21706
FOHLEN, G. M. N86-21686
FOK, F. Y. S. N86-21737
FOKIN, V. G. N86-21977
FONTANA, J. R. N86-22380
FOO, Y. K. N86-22201
FORBES, K. R. N86-21705
FORD, W. K. N86-22363
FORSEN, R. N86-21966
FORSYTH, G. F. N86-21537
FOSTER, J. C. N86-21702
FOSTER, J. C., JR. N86-21705
FOX, M. S. N86-22176
FRAIZE, W. N86-22453
N86-22454
FRALICK, G. C. N86-22150
FRANCIS, C. L. N86-21766
FRANK, C. N86-21530
FRANKLIN, R. E. N86-21811
FRAREY, J. L. N86-21857
FREEMAN, W. G. N86-21545
FREIFELDER, R. H. N86-22404
FREIVALDS, A. N86-22101
FRENCH, D. N86-21731
FRICKE, J. N86-21987
FRIEDJUNG, M. N86-22472
FRIEND, C. M. N86-22343
FROMHOLD, A. T. N86-22460
FRORIEP, R. N86-21553
FROST, A. L. N86-21507
FRY, C. F. N86-22535
FUERSTENAU, N. N86-22399
FUJITA, H. N86-22403
FULLER-ROWELL, T. J. N86-22039
FULLER, K. N86-22080
FUNKHOUSER, G. E. N86-22116

G

GABRIEL, A. H. N86-22481
GABRIEL, W. F. N86-21732
GAFFNEY, J. S. N86-22352
GAFUROV, K. G. N86-22268
GAHM, G. N86-22413
GAIER, J. R. N86-21683
GALKIN, A. M. N86-22260
GALL, P. D. N86-21518
GALLO, D. A. N86-22438
GARDINER, J. C. N86-22245
GARMIRE, G. P. N86-22480
GARNER, H. R. N86-22403
GARNIER, J. C. N86-21807
GARODZ, L. J. N86-21944
GARRETT, R. N86-22338
N86-22343
GARRETT, R. F. N86-22334
N86-22335
GARVER, W. P. N86-22349
GAUSE, L. W. N86-21621
GEE, P. N86-21774
GEIST, G. A. N86-22143
GELFAND, J. N86-22187
GELMUKHANOV, F. K. N86-22255
GENG, Z. N86-22416
GENT, A. N. N86-21696
GERY, W. J. N86-22070
GETOFF, N. N86-21992
GHARIB, M. N86-21519
GHOTRA, J. S. N86-21692
GIBSON, R. F. N86-21898
GIKEN, M. N86-21724
GILES, G. L. N86-21954
GILL, R. D. N86-22117
N86-22121
N86-22154
GILLESPIE, J. W., JR. N86-21618
GILLHAM, J. K. N86-21691
GINZBURG, I. P. N86-21795
GISOLFI, C. V. N86-22100
GIUSE, D. N86-22139
GLAESER, A. M. N86-21701
GLASGOW, T. K. N86-21659
GLASS, T. E. N86-21704
GLASSER, L. A. N86-21771
GLUCK, R. N86-21925
GLYNN, P. W. N86-22239
GOLD, S. H. N86-21845
GOLDFARB, D. N86-22138
GOLDMAN, D. N86-22060
GOLDOBIN, I. C. N86-22274
GOLDOVSKIY, D. Y. N86-21563
GOLDOWSKY, M. N86-21714
GOLUB, L. N86-22482
GOLUBENKO, I. V. N86-22283
GOLUBKIN, V. N. N86-22258
GOMER, R. N86-22428
GONTIS, V. G. N86-22278
GONZALEZ, A. L. C. N86-22025
GONZALEZ, W. D. N86-22025
GOODENOUGH, J. N86-22157
GOODMAN, Z. M. N86-22358
GORDINA, T. A. N86-21627
N86-21631
GORDON, R. N86-22039
GORDON, Y. V. N86-22276
GORENSTEIN, P. N86-22488
GOSSARD, T., JR. N86-21601
GOSSMAN, W. E. N86-22251
GRAHAM, R. A. N86-21698
GRANATSTEIN, V. L. N86-21845
GRANT, D. N86-22074
GRAUL, R. A. N86-21555
N86-21556
GRAY, C. G. N86-22098
GREELEY, R. N86-22516
GREEN, B. D. N86-22318
GREENLEAF N86-21805
GREENWALD, R. A. N86-22051
GREER, R. G. H. N86-22031
GRETZ, J. N86-21993
GRIFFIN, J. H. N86-21892
GRIMES, R. M. N86-22322
GRISHIN, A. M. N86-21633
GROLIER, M. J. N86-21971
GROSSMANN, K. U. N86-22033
GROVE, T. L. N86-22517
GROVER, J. R. N86-22359
N86-22360
N86-22361
N86-22362
GROVES, G. V. N86-22048
GRUNINGER, J. H. N86-22187
GRUNTHANER, P. N86-21636
GRUPE, J. C. N86-22164
GUERDAL, Z. N86-21594
GUIBERT, J. P. N86-21807
GUILBERT, P. N86-22463
GUNDEM, T. I. N86-22144
GUNDERSEN, M. A. N86-21764
GUNGER, M. E. N86-21705
GUOSHENG, Z. N86-21663
GURLL, N. J. N86-22100
GUSTAFSSON, H. A. N86-22384
GUTBROD, H. H. N86-22384

H

HACKMAN, D. J. N86-21668
HADIMIOGLU, B. B. N86-22301
HAELBICH, R. P. N86-22332
HAFTKA, R. T. N86-21594
HAGER N86-21848
HAINES, D. W. N86-21897
HALLY, D. N86-22179
HAMILTON, D. C. N86-21783
HAMISCH, H. N86-21756
HAMROCK, B. J. N86-21797
HANDLER, T. N86-22381
HANDWERKER, C. A. N86-21666
HANKS, S. N86-22170
HANLEY, J. T. N86-22046
HANNAH, M. R. N86-22126
HANSEN, A. F. N86-21846
HANSEN, L. N86-22484
N86-22485
HANSMA, P. K. N86-21819
N86-22419
HANSON, A. J. N86-21818
HANSON, D. M. N86-22367
HARCH, W. H. N86-21823
HARDING, J. N86-21626
HARDING, R. N86-21929
HARDIS, J. E. N86-21834
HARDY, T. L. N86-21578
HARELAND, W. A. N86-21833
HARIHARAN, S. I. N86-22309
HARNDEN, F. R. N86-22482
HARPAZ, A. N86-22238
HARRIS, C. E. N86-21611
HARRISON, R. F. N86-22249
HARSHVARDHAN N86-22022
HART, E. L. N86-22381
HARTMAN, A. N86-21839
HASHIZUME, T. N86-21664
HASSELMAN, D. P. H. N86-21959
HASTINGS, S. R. N86-21986
HATTORI, K. N86-22403
HAWKE, B. R. N86-22521
N86-22526
HAYAKAWA, S. N86-22470
HAYASHI, M. N86-21790
HAYDUK, R. J. N86-21933
N86-21934
HAYES, R. G. N86-22368
HAZELTINE, R. D. N86-22412
HECHT, M. H. N86-22364
HEDRICK, J. C. N86-21613
HEDRICK, J. L. N86-21613
HEERING, J. N86-22117
HEIDNER, R. F., III N86-21843
HEIMBUCH, A. H. N86-21590
HEINTZENBERG, J. N86-22009
HEINZ, W. N86-22029
N86-22041
HELFAND, D. J. N86-22500
HELMREICH, F. N86-22248
HEMBREE, G. N86-21839
HEMPSTEAD, M. N86-21643
HENDERSON, D. E. N86-22114
HENNING, C. D. N86-22407
HENRIKSEN, K. N86-22028
HEPPNER, J. P. N86-22029
HERAKOVICH, C. T. N86-21595
N86-21599
HERBERT, T. N86-21804
HERGENROTHER, P. M. N86-21675
HERMANSON, J. C. N86-21788
HESS, R. A. N86-21550
HETTRICK, M. C. N86-22498
HEYDARI, F. N86-21533
HIBATA, Y. N86-21678
HIDEKUMA, S. N86-22403
HIGGINS, E. A. N86-22116
HILDRETH, E. C. N86-22395
HILL, C. K. N86-21506
HILL, R. G. N86-21529
HILL, R. J. N86-21733
HILLIS, D. L. N86-22410
HIMPSEL, F. J. N86-22346
N86-22347
N86-22348
HIROSE, H. N86-21509
HIRSCHFELD, D. A. N86-21595
HJORT, N. L. N86-22241
HO, S. K. N86-22382
HOFFMANN, H. E. N86-22064
HOFFMANN, M. R. N86-22017
HOFFMANN, R. M. N86-21871
HOLKA, D. N86-21661
HOLLAND, D. M. P. N86-21834

HOLLANDER, M. N86-22232
HOLLINGE, G. N86-22348
HOLMER, C. I. N86-21919
HOLMES-FARLEY, S. R. N86-22425
HOLMES, B. J. N86-21518
HOLROYD, R. A. N86-22353
HONG, J. N86-21773
N86-22217
HOOVER, R. B. N86-22459
HORNICK, S. W. N86-22132
HOULBERG, W. A. N86-22411
HOULSBY, G. T. N86-22227
N86-22228
HOUSNER, J. M. N86-21953
HOWARD, W. E. N86-21601
HOWELL, L. W. N86-21559
HOWELLS, M. R. N86-22371
HOWES, W. L. N86-22390
HOYNIAK, D. N86-21513
HSU, C. H. N86-21520
HSU, M. T. S. N86-21590
HUANG, W. S. N86-21695
HUBBARD, J. E., JR. N86-21924
HUBBARD, M. W. N86-21566
N86-21567
HUBBARD, R. W. N86-22102
HUBER, A. H. N86-22015
HUETHER, W. N86-21680
HUGENSCHMIDT, M. N86-21815
HUGHES, G. N86-22345
N86-22346
HUGHES, G. J. N86-22348
HUI, E. T. N86-22360
N86-22361
HULBERT, S. L. N86-22336
HULTHAGE, I. N86-22176
HUNG, S. T. N86-22193
HUNKINS, K. N86-22062
HUTCHISON, L. D. N86-22163
HUTH, T. C. N86-22320
HWU, C. S. N86-22229
HYER, M. W. N86-21598
N86-21603
HYLTON, L. D. N86-21546
HYMAN, E. A. N86-22002

I

IBARAKI, R. Y. N86-21739
IBBOTT, T. N86-22130
IBRAHIM, R. A. N86-21552
IDNURM, S. I. N86-22284
IGATA, N. N86-21664
IGLEHART, D. L. N86-22239
IKEGAMI, R. N86-21921
ILICHEV, L. V. N86-22255
ILOVAISKY, S. A. N86-22468
INGELS, J. N86-22021
INMAN, D. J. N86-21927
IOZEPSON, Y. I. N86-22284
IRENE, E. A. N86-22420
N86-22421
N86-22422
N86-22424
IRIARTE, D. R. N86-22094
IRLWECK, K. N86-22008
ISAYEV, A. A. N86-22272
ISHIGURO, T. N86-21516
IVANOV, B. A. N86-22507
IVANOV, V. I. N86-22275

J

JACKSON, B. S. N86-21604
JACKSON, B. V. N86-22509
JACKSON, D. N86-22092
JACOB, D. J. N86-22017
JACOBS, O. L. R. N86-22226
JACOBSEN, A. R. N86-22108
JACOBSEN, C. N86-22372
JAEGER, F. N86-21995
JAMES, M. R. N86-21963
JARPE, S. P. N86-22053
JATA, K. V. N86-21667
JAY, R. L. N86-21888
JAYARAM, V. N86-21651
JEGLEY, D. C. N86-21617
JEGOUDEZ, G. N86-22496
JENG, Y. R. N86-21797
JENNE, R. L. N86-22081
JENSEN, D. L. N86-21904
JENSEN, P. L. N86-22489
N86-22495
N86-22499
JEONG, J. N86-21696
JIA, S. Q. N86-22417
JIANG, J. K. N86-22300
JINKS, B. W. N86-21775
JOANIDES, J. N86-21905
JOERGENSEN, H. E. N86-22484
N86-22485
JOHNSEN, R. N86-21645
JOHNSON, A. G. N86-22084
N86-22085
JOHNSON, C. D. N86-21910
JOHNSON, D. L. N86-22023
JOHNSON, E. R. N86-21597
JOHNSON, K. A. N86-21672
JOHNSON, M. J. N86-22304
N86-22305
JOHNSON, P. N86-22331
N86-22513
JOHNSON, P. D. N86-22336
N86-22340
JOHNSON, R. A. N86-21937
N86-22244
JOHNSON, R. P. N86-21554
JONA, F. P. N86-22334
N86-22335
JONASSON, P. N86-22499
JONES, D. I. G. N86-21886
N86-21902
JONES, P. N86-21731
JONES, R. M. N86-21601
JONES, S. P. N86-22183
JONES, W. R., JR. N86-21575
JORAAS, P. N86-22476
JORDAN, J. N86-22345
JORDAN, J. L. N86-22346
N86-22348
JOSEPH, T. A. N86-22447
JOUHAUD, F. N86-21807
JUNGERT, E. N86-22455
JUREK, Z. J. N86-22235
JUST, T. N86-21630

K

KACHANOV, Y. S. N86-21793
KACHARE, A. H. N86-21981
KAGANO, M. T. N86-22059
KAHLE, A. B. N86-21970
KAHN, S. M. N86-22498
KALAGIN, A. P. N86-22257
KALASKY, E. N86-22375
KAMPERT, K. H. N86-22384
KANAYEV, A. V. N86-22273
KANE, R. P. N86-22057
KANJILAL, P. P. N86-22200
KAPLAN, M. S. N86-22284
KARNESKY, R. A. N86-22379
KASHA, H. N86-22351
KASSING, D. N86-21996
KATO, K. N86-21634
KATZENSTEIN, A. M. N86-21998
KAUFMAN, D. L. N86-21979
KAUFMAN, R. M. N86-21546
KAWAMOTO, T. N86-22403
KAYSER, H. N86-21734
KEDDY, E. S. N86-21806
KELLER, C. M. N86-21735
KELLIHER, W. C. N86-21518
KEMP, B. L. N86-21597
KENNEY, C. S. N86-22394
KENNEY, J. M. N86-22372
KERLEY, J. N86-21891
KERNER, A. N86-22065
KERWIN, E. M., JR. N86-21913
KESSELRING, P. N86-21994
KEUNG, C. N86-21714
KEVAN, S. N86-22327
KEVAN, S. D. N86-22328
N86-22329
KHABLO-GROSSVALD, Y. G. N86-22457
KHANNA, S. K. N86-22418
KHATRI, C. G. N86-21779
KHAYRETDINOV, K. A. N86-22274
KHOLODILOV, A. A. N86-22267
KIENHOLZ, D. A. N86-21910
KIM, B. Y. N86-22389
KIM, C. H. N86-21616
KIM, Y. W. N86-21616
KIMBALL, K. M. N86-21784
KING, C. W. N86-22068
KING, J. F. N86-21673
KING, M. D. N86-22022
KING, R. B. N86-22216
KING, W. T. N86-22378
KINTZER, E. S. N86-22391
KIRCHHOF, W. N86-21972
KIRILLIN, V. A. N86-22405
KIRZ, J. N86-22372
N86-22373
KITAGAWA, M. N86-21876
N86-21877
KIZILOGLU, U. N86-22477
KLAFFKY, R. N86-22326
KLAFFKY, R. W. N86-22331
KLAISS, H. N86-21985
KLASSEN, S. E. N86-21713
KLEMM, R. B. N86-22359
KLUESENER, M. F. N86-21912
KLUG, J. N86-22490
KNEEBURG, S. N86-22162
KNIBB, R. R. N86-22065
KNIGHT, C. E., JR. N86-21593
KNIGHT, T. F., JR. N86-21771
KNOX, L. N86-21714
KO, R. W. C. N86-21620
KOBEDA, E. N86-22420
KOBLE, R. D. N86-22442
KOBRICK, J. L. N86-22104
KOCEVAR, P. N86-21778
KOCH-MIRAMOND, L. N86-22501
KOCH, K. L. N86-22095
KOCH, L. M. N86-22166
KODAKA, T. N86-21836
KOENIG, J. L. N86-21584
KOHLMEIER, H. H. N86-21812
KOK, J. N86-22158
KOLB, B. N86-22384
KOLKMAN, H. J. N86-21544
KOLNINOV, O. V. N86-21627
N86-21631
KOMOV, B. V. N86-21627
KONIG, C. E. N86-21740
KORNFELD, C. D. N86-22127
KORNFELD, J. R. N86-21736
KOROBEYNIKOV, V. P. N86-22259
KOROLKOVA, N. V. N86-22287
KOROTEV, R. L. N86-22518
KORUKONDA, B. N86-21591
KOSMAHL, H. G. N86-21742
KOSOWER, E. M. N86-22088
KOSUT, R. L. N86-22192
KOTCHICK, D. M. N86-21870
KOTEROV, V. N. N86-22261
KOTOV, B. V. N86-21631
KOURA, K. N86-22314
KOUVARITAKIS, B. N86-22198
N86-22199
N86-22249
KOZLOV, G. I. N86-22266
KOZLOV, V. V. N86-21793
KRIER, H. N86-21711
KRINDACH, D. P. N86-22268
KRIZ, R. D. N86-21606
KROHN, E. O. N86-21524
KRUMMACHER, S. N86-22333
KUBASOV, V. N. N86-21563
KUCHTA, J. M. N86-21528
KUEHN, A. N86-21558
KUHBANDER, R. J. N86-21697
KUHN, K. J. N86-21840
KUKHTENKO, A. I. N86-21560
KULAKOV, S. V. N86-21828
KUMAR, D. N86-21686
KUMAZAWA, R. N86-22403
KUNATH, R. R. N86-21757
KUO, J. N86-21748
KUO, J. T. N86-22047
KUROKHTIN, N. V. N86-22287
KURZWELL, L. G. N86-21907
KUTEYEV, B. V. N86-22294
KUZMENKO, P. J. N86-22401
KUZNETSOV, V. A. N86-22266

L

LABANTI, C. N86-22497
LACATSKI, J. T. N86-22411
LADIKOV-ROYEV, Y. P. N86-21560
LAGNESE, T. J. N86-21886
LAGRECA, P. D. N86-21900
LAKE, M. S. N86-21569
LAMB, M. N86-21514
LAMBE, J. N86-22418
LAMBERT, W. P. N86-22006
LAMOREAUX, M. E. N86-21820
LAN, C. E. N86-21520
LANDE, K. N86-22536
LANDGREN, G. N86-22345
LANE, N. E. N86-22167
LANG, H. R. N86-21970

LANGLEY, P. N86-22191
LANGRAN, G. N86-22141
N86-22173
N86-22175
LARIBI, A. N86-22128
LAROCCI, M. N86-22371
LARSEN, R. C. N86-22351
LARSSON, M. N86-22037
LATCHMAN, H. N86-22198
N86-22199
LAUF, R. J. N86-21700
LAUL, J. C. N86-22524
LAUWERIER, H. A. N86-22155
LAWLESS, K. R. N86-21694
LAWRIE, L. N86-22174
LAWSON, A. C. N86-22433
LAY, R. N86-22453
N86-22454
LAYTON, D. M. N86-21539
LEAVITT, R. P. N86-21846
LEBEDEV, A. N. N86-22262
LEBEDEV, V. S. N86-22297
LEBLANC, J. N86-22496
LEBOWITZ, J. L. N86-21776
LECHNER, W. N86-21531
LEDBETTER, H. M. N86-21901
LEDUC, H. G. N86-22418
LEE, B. T. N86-21895
LEE, G. F. N86-21899
LEE, J. G. N86-21616
LEE, L. C. N86-21646
LEE, M. H. N86-21773
N86-22217
LEEUWEN, E. H. V. N86-21800
LEFEBVRE, A. H. N86-21545
LEHMAN, D. R. N86-22323
LEIBOLD, A. F. N86-21570
LEIGHTON, F. T. N86-21765
LEISERSON, C. E. N86-21765
N86-21771
LEISSA, A. W. N86-21623
N86-21909
LEMAIRE, J. N86-22019
N86-22020
LENKE, L. R. N86-21555
N86-21556
LENNART, A. N86-21838
LENNON, L. M. N86-22010
LEPICOVSKY, J. N86-22303
LEPILKIN, A. M. N86-21510
LESLIE, W. C. N86-21663
LESNYAKOV, G. G. N86-22296
LESTER, W. A., JR. N86-22322
LETOKHOV, V. C. N86-22282
LEVCHENKO, V. Y. N86-21793
LEVENTHAL, J. J. N86-22349
LEVER, A. B. P. N86-21643
N86-22317
LEVIN, V. A. N86-22265
LEVY, B. N86-22231
LEWIS, E. A. N86-22424
LEWIS, P. F. N86-22318
LI, Z. N86-21881
LIANG, T. N86-22247
LIEN, S. L. C. N86-22145
LIMANSKIY, A. V. N86-21512
LIN, T. N86-22146
LINDALE, E. N86-21714
LINDAU, I. N86-22364
LINDE, M. N86-22312
LINDQUIST, P. A. N86-22531
LINDSTROM, M. M. N86-22519
LINZHEN, J. N86-21710
LIPSIUS, H. C. N86-21662
LIPSON, S. G. N86-22392
LIPTUGA, A. I. N86-22256
LISITSA, V. S. N86-22278
LIU, D. N86-21522
LIU, H. W. N86-21654
N86-21951
LIU, W. N86-21643
LIU, W. T. N86-22024
LLEWELLYN, J. P. N86-21624
LOBACHEV, V. A. N86-22277
LOEB, F. E. N86-22339
LOEHNER, H. N86-22384
LONG, J. A. N86-22440
LONGDON, N. N86-22461
LONGHI, J. N86-22520
LOOS, A. C. N86-21600
N86-21619
LOUWAARD, E. P. N86-21657
LOVELAND, D. W. N86-22207
LUBKER, S. L. N86-22081
LUCAS, N. N86-22365
N86-22366
N86-22367
LUCCIO, A. N86-22330
LUCEY, P. G. N86-22521
LUDEKE, R. N86-22345
LUDEWIGT, B. N86-22384
LUHMANN, N. C., JR. N86-22377
LUI, K. M. I. N86-22133
LUMB, D. N86-22505
LURIE, J. B. N86-22050
LUSSIER, A. R. N86-22104
LYABIN, N. A. N86-22272
LYAKISHEV, V. G. N86-22267
LYNE, P. J. N86-22116
LYSIKOV, Y. I. N86-22295

M

MACEWEN, J. D. N86-22097
MACHUEV, Y. I. N86-21977
MACK, E. J. N86-22046
MADIGOSKY, W. N86-21896
MADSEN, M. M. N86-22499
MAFFEO, R. N86-21932
MAIKIN, V. M. N86-22415
MAIOCCO, L. J. N86-22010
MAISH, A. B. N86-22001
MAJER, P. N86-22482
MAJOR, C. S. N86-21925
MAKSIMOV, V. P. N86-21793
MALAFAYEV, V. A. N86-22292
MALEVICH, I. A. N86-22275
MALINOVSKAYA, S. A. N86-22284
MAMMONE, R. J. N86-21647
MANHEIMER, W. M. N86-21845
MANNING, J. R. N86-21648
N86-21666
MANUEL, G. S. N86-21518
MAR, J. W. N86-21884
MARCHEVSKIY, F. N. N86-21841
MARCHIK, I. I. N86-22415
MARESCA, R. N86-21714
MARINOV, M. N86-21681
MARKELOV, N. V. N86-21632
MARKOVA, D. N86-21677
MARKS, P. J. N86-22005
MAROVSKI, G. N86-22273
MARSTON, P. L. N86-22310
MARTIN, E. B. N86-22351
MARTYNYUK-LOTOTSKAYA, A. N. N86-21583
MARUSAK, T. J. N86-21872
MASSOUD, H. Z. N86-22421
MASUNO, K. N86-21508
MATOSDEMEDEIROS, V. N86-21570
MATSUDA, H. T. N86-21832
MATSUMOTO, T. N86-21982
MATSUMOTO, Y. N86-21859
MATSUNO, K. I. N86-21516
MATSUOKA, M. N86-22483
MATTHEWS, A. E. N86-21692
MATTHYS, E. F. N86-21786
MATYUSHENKO, V. I. N86-22276
MAUDGAL, S. N86-21685
MAURICE, L. Q. N86-21707
MAUSER, W. N86-21972
MAY, C. J. N86-21946
MCANALLY, W. H., JR. N86-22073
MCCAULEY, J. F. N86-21971
MCCONNAUGHEY, H. V. N86-22214
MCCORKLE, J. W. N86-21821
MCCORMCK, R. F. N86-21948
MCDERMOTT, D. N86-22170
MCDERMOTT, D. B. N86-22377
MCDONNELL, L. N86-22331
MCFEELY, F. R. N86-22347
N86-22348
MCGOWAN, P. E. N86-21953
MCGRATH, J. E. N86-21613
MCKAY, D. S. N86-22513
MCLAUGHLIN, J. C. N86-21674
MCMILLAN, W. G. N86-22042
MECHEL, F. N86-21792
MEIJER, S. N86-22312
MEISS, J. D. N86-22412
MELDRUM, D. R. N86-22113
MELITA, O. N86-22461
MELNIK, M. N86-21643
MELSAARD, D. M. N86-21833
MENDELSOHN, A. J. N86-22313
MERKULOV, V. I. N86-21560
MERRIGAN, M. A. N86-21806
MESSIER, R. N86-22431
MEWE, R. N86-22492
MIAMEE, A. G. N86-22210
MICKENS, R. E. N86-22224
MIELKE, D. L. N86-22356
MIELKE, M. N86-21905
MIHALCZO, J. T. N86-22378
MIKHANTEV, B. I. N86-21627
MIKHEYEV, L. D. N86-22273
MILANICH, A. I. N86-22269
MILES, R. F., JR. N86-22151
N86-22152
N86-22153
MILES, R. N. N86-21917
MILLER, D. N86-21864
MILLER, G. N86-21655
MILLER, J. N86-21584
MILLER, S. N86-22173
MILLER, S. M. N86-22050
MILLER, V. R. N86-21923
MILLHOLLEN, M. K. N86-22379
MILLNER, A. R. N86-21979
MIMMACK, G. M. N86-22230
MINA, C. N86-21982
MINOGIN, V. G. N86-22262
MINSHIN, V. I. N86-22265
MINZHONG, Z. N86-21951
MIRON, J. H. D. N86-21543
MISHELL, R. I. N86-22086
MISRA, A. K. N86-21658
MISRA, M. S. N86-21900
MITCHELL, A. C. N86-21783
MITEV, G. N86-22325
MITTER, S. K. N86-22231
MITTRA, R. N86-21728
N86-21730
N86-21763
MIZUNO, T. N86-21628
MOBERG, B. N86-22009
MOFFETT, R. N86-22039
MOLINARI, R. L. N86-22079
MOM, A. J. A. N86-21544
MONACO, M. E. N86-22012
MONTANO, J. W. N86-21950
MONTEMAYOR, A. F. N86-21708
MONZIONE, N. M. N86-22010
MORALES, W. N86-21575
MORAN, M. L. N86-22147
MORAR, J. F. N86-22345
N86-22346
N86-22347
N86-22348
MOREAU, G. N86-22490
MOREHOUSE, K. A. N86-21794
MOREL, P. R. N86-21825
MORGAN, K. N86-21754
MORINO, L. N86-21521
MOROSIN, B. N86-21698
MORRIS, D. H. N86-21611
MORRIS, F. W. L. N86-21963
MORRIS, J. W., JR. N86-21867
MORRIS, R. V. N86-22513
MORRISON, C. A. N86-21846
MORRISON, P. J. N86-22412
MORSE, A. S. N86-22195
MOSCHANDREAS, D. J. N86-21874
MOURA, A. D. N86-22059
MOVICK, W. K. N86-21831
MUEHLBAUER, P. N86-21541
MULHOLLAND, G. N86-21839
MULLAN, D. J. N86-22458
MULLEN, J. G. N86-22321
MULLEN, S. N86-22104
MUNCE, A. C., JR. N86-22400
MUNGER, J. W. N86-22017
MURATA, D. L. N86-21566
N86-21567
MURGAI, V. N86-22336
N86-22337
N86-22338
N86-22341
N86-22342
MURPHY, H. C. N86-22318
MURPHY, M. J. N86-21873
MURRAY, S. B. N86-21803
MURTAGH, D. P. N86-22031
MURTHY, P. L. N. N86-21614
MUSHOTZKY, R. N86-22464
MUSIKANT, S. N86-22451
MUSTER, W. J. N86-21606
MUSZYNSKA, A. N86-21902
MYERS, J. R. N86-21688
MYERS, K. J. N86-22106

N

NAGHDI, P. M. N86-21665
NAKAMURA, K. N86-21724
NANSTAD, R. K. N86-21673
NASH, D. O. N86-21548
NATHAN, T. R. N86-22055

NAUMANN, R. J. N86-21684
N86-21718
NAZAROV, A. N86-21977
NEATHAMMER, R. D. N86-22110
NEFF, W. D. N86-22088
NEGODA, V. V. N86-22258
NELLIS, W. J. N86-21783
NELSON, M. C. N86-22367
NERI, D. F. N86-22108
NESBITT, F. L. N86-22359
NETESOV, V. V. N86-22265
NEVEJANS, D. N86-22021
NEVIN, A. N86-21643
NEWMAN, J. K. N86-22360
N86-22361
NGUYEN, V. D. N86-21866
NICHOLAS, T. N86-21965
NICKEL, G. H. N86-22408
NICKERSON, G. R. N86-21579
NICOL, D. M. N86-22250
NIKKEL, D. J., JR. N86-21665
NIKOLAEV, V. N. N86-22257
NILSSON, A. A. N86-22189
NISHIMOTO, T. S. N86-21920
NITSCH, J. N86-21985
NOBLE, G. T. N86-22449
NOLAND, J. W. N86-22005
NOLLER, D. N86-21862
NOMOTO, K. N86-22475
NONAKA, I. N86-21876
N86-21877
NONAMI, K. N86-21856
NOORGAARD-NIELSEN, H. U. N86-22465
N86-22484
N86-22485
NORDSTROEM, J. N86-21809
NORMAN, R. W., JR. N86-22436
NOUSEK, J. A. N86-22480
NOVICK, R. N86-22500

O

OBERLE, L. G. N86-22150
ODEAN, M. J. N86-22085
ODEN, J. T. N86-21957
OEN, C. N86-22007
OGIER, R. G. N86-22172
OHEARN, D. B. N86-21500
OHMAN, J. N86-21530
OKAMURA, S. N86-22403
OKHOTNIKOV, O. G. N86-22274
OKS, E. A. N86-22291
OLAOSEBIKAN, O. N86-21605
OLSON, W. W. N86-21860
ONDREY, G. N86-22355
ONEILL, H. J. N86-21874
ONUMA, H. N86-21836
OPITZ, H. N86-22069
OPPENHEIM, U. P. N86-22392
ORIOL, R. N66-22075
ORTIZ, K. N86-21961
ORUP, P. N86-22499
OSHAWA, Y. N86-22402
OSHIDA, Y. N86-21654
OTOMO, A. N86-21876
N86-21877
OTT, R. H. N86-22222
OVERFELT, R. A. N86-21652
OWENS, E. C. N86-21708
OWENS, L. J. N86-22452
OXENDER, D. N86-22092
OYEGBESAN, A. O. N86-21791

P

PAARDEKOOPER, M. H. C. N86-22253
PABST, W. N86-21511
N86-21535
N86-21855
PACKER, L. N86-22082
PAERELS, F. N86-22492
PAK, G. T. N86-22274
PAKULL, M. N86-22473
PALINKAS, L. A. N86-22109
PALMADESSO, P. J. N86-22045
PALMER, B. A. N86-22409
PALMER, D. C. N86-21702
PAN, V. N86-22161
PAN, X. N86-22339
PANDEY, D. K. N86-21816
PANEK, A. A. N86-22165
PANG, K. F. N86-21744
PAO, C. K. N86-21768
PAPIKE, J. J. N86-22524
PARKER, J. A. N86-21590
N86-21686
PARKER, J. R. N86-21827
PARKER, J. W. N86-22534
PARKS, R. D. N86-22369
PARR, A. C. N86-21834
PASANELLA, E. L. N86-21941
PATTON, J. S. N86-21785
PAUL, R. A. N86-22014
PAVLENKO, V. S. N86-22276
PAYLOR, E. D. N86-21970
PAYNE, R. C. N86-22302
PEACOCK, A. N86-22474
PECHENIK, A. N86-21976
PEEBLES, J. N86-21930
PELIGRAD, M. N86-22223
PENFIELD, P., JR. N86-21771
PENG, Q. N86-22478
N86-22479
PEREIRA, A. E. C. N86-22025
PERLA, I. N86-22039
PERLOV, S. G. N86-22261
PERNIC, E. N86-22129
PETERS, R. M. N86-22103
PETERSON, A. F. N86-21730
PETNIKOVA, V. M. N86-22271
PFEIFER, D. N86-22206
PHILLIPS, R. J. N86-21968
PICKERING, H. W. N86-21960
PILKEY, W. D. N86-21551
PING, G. N86-21669
PIPER, L. G. N86-22318
PIPES, R. B. N86-21618
PIRO, L. N86-22472
PISKARSKAS, A. N86-22263
PLATUS, D. H. N86-21565
PLESHANOV, S. A. N86-22271
N86-22289
PLUEDDEMANN, E. P. N86-21584
PLUMMER, E. W. N86-22363
PLYSHEVSKAYA, T. M. N86-22261
POCHKOWSKI, M. N86-22408
PODELL, J. H. N86-22169
POE, C. C., JR. N86-21607
POLIVANOV, Y. N. N86-22280
POLLAK, R. A. N86-22346
POLYAKOV, N. F. N86-21796
POPE, G. G. N86-21532
POPPLEWELL, J. N86-21624
POROPAT, G. V. N86-21822
POSKANZER, A. M. N86-22384
POWELL, M. G. N86-21953
PRATUCH, S. M. N86-22184
PRAVEDNIKOV, A. N. N86-21627
N86-21631
PREMUZIC, E. T. N86-22352
PREPARATA, F. P. N86-21758
PRESES, J. N86-22350
N86-22354
N86-22355
PRESES, J. M. N86-22349
N86-22353
PRESSON, E. P. N86-22178
PREVENAS, E. A. N86-22134
PRIDE, J. D. N86-21949
PRIESTLEY, J. T. N86-21733
PRITCHARD, G. N86-21692
PROCHAZKA, S. N86-21573
PROKHOROV, A. M. N86-22270
PRONO, D. S. N86-22386
PROSCHAN, F. N86-22135
N86-22182
N86-22230
N86-22232
PRUCZ, J. N86-21930
PRZBYLINSKI, R. W. N86-22070
PULFREY, D. L. N86-21775
PURCELL, W. R. N86-22491
PUTNAM, A. A. N86-21873
PUTYATIN, B. V. N86-22259

Q

QUARTERONI, A. N86-22204
QUEGAN, S. N86-22039
QUICK, C. R., JR. N86-22350
QUINTANA, J. N86-21868

R

RAAEN, S. N86-22337
N86-22338
N86-22369
RABINOVITCH, B. S. N86-22319
RABITZ, H. N86-22187
RACER, R. I. N86-22065
RADENKOV-YANEVA, M. N86-21681
RAEMER, H. R. N86-22243
RAFF, L. M. N86-22426
RAKHVALSKIY, M. P. N86-22274
RAMACHANDRA, S. M. N86-21517
RAMANATHAN, M. N86-22005
RAMASWAMY, S. N86-22233
RAND, S. C. N86-22396
RAO, C. M. N86-21653
RAO, C. R. N86-21779
RAO, V. B. N86-21761
RAPACKI, G. R. N86-21926
RARBACK, H. N86-22372
RASMUSSEN, H. E. N86-22499
RASMUSSEN, I. L. N86-22485
RATNASWAMY, M. J. N86-22079
RAVN, H. R. N86-22496
RAWLINS, W. T. N86-22032
RAZZHIVIN, B. P. N86-21828
REDDY, A. D. N86-21622
N86-21930
REDDY, J. N. N86-21596
N86-21869
REED, I. S. N86-22177
REES, D. N86-22029
N86-22039
N86-22041
REEVE, J. N. N86-22089
REHFIELD, L. W. N86-21622
N86-21930
REIF, J. H. N86-22161
N86-22208
N86-22209
N86-22212
REIFSNIDER, K. L. N86-21608
REINHARDT, B. A. N86-21676
RELWANI, S. M. N86-21874
RESSLER, W. H. N86-22111
REYNOLDS, D. G. N86-22100
REYNOLDS, P. F., JR. N86-22250
RICCIARDELLI, J. N86-21714
RICCIARDI, O. N86-22472
RICE, J. B. N86-22089
RICE, R. B. N86-21894
N86-21926
N86-21928
RICHNER, H. N86-22067
RICKER, R. E. N86-21670
RICKETT, B. J. N86-22509
RIEGER, N. F. N86-21890
RILEY, J. P. N86-21733
RIORDAN, J. M. N86-22007
RITTER, H. G. N86-22384
RIVEST, R. L. N86-21771
ROBBINS, R. E. N86-22180
ROBERTS, R. A. N86-21882
ROBERTSON, T. N86-22242
ROBERTSON, T. F. N86-21635
ROBINSON, S. M. N86-22205
ROCCHIA, R. N86-22496
N86-22501
ROCKOWER, E. B. N86-21842
RODRIGUEZ, R. C. N86-21554
ROE, F. D. N86-22114
ROEDER, J. L. N86-22049
ROEMISH, L. Y. N86-22439
ROGALIN, V. Y. N86-22270
ROGERS, C. A. N86-21593
ROGERS, L. N86-21883
N86-21885
ROGERS, W. H. N86-22108
ROGL, P. N86-21640
ROHLICEK, J. R. N86-22219
ROLFE, J. L. N86-22099
ROMAN, P. N86-21769
ROMANENKO, V. I. N86-22299
ROSCOE, S. N. N86-22115
ROSEN, L. N86-22383
ROSENBAUM, F. J. N86-22427
ROSENBERG, G. N86-21562
ROSENBLAT, S. N86-21799
ROSHKO, A. N86-21519
ROSINBERG, M. L. N86-21776
ROSINSKI, J. N86-22211
ROSNER, R. N86-22482
ROSSER, R. N86-22372
ROSSER, R. W. N86-21582
ROSSI, J. N86-22160
ROSSMANN, A. N86-21680
ROTH, A. N86-21523
ROTH, M. A. N86-22533
ROTHBERG, G. M. N86-22364
ROTHSCHILDS, R. N86-21618
ROTHWELL, P. L. N86-22159

ROUSSEAU, C. Q. N86-21598
ROUVRAY, D. H. N86-22252
ROVINSKIY, R. Y. N86-22270
ROY, N. N. N86-22279
ROY, S. N86-21869
ROZEWICZ, J. N86-21811
RUBEY, W. A. N86-21709
RUCKMAN, M. W. N86-22340
N86-22341
N86-22342
RUF, J. H. N86-21559
RUPPERT, D. N86-22246
RUSSELL, D. N86-22006
RUSSELL, P. N86-21982
RYCHENER, M. D. N86-22176
RYDER, G. N86-22522

S

SAAD, Y. N86-22186
SACHS, H. N86-21731
SAGAL, M. N86-22171
SAHA, B. S. N86-21854
SAHAI, Y. N86-22030
SAKA, K. N86-21626
SAKURAI, A. N86-21790
SAKURAI, T. N86-21664
SALDIVAR, J. T. N86-22116
SALPAS, P. A. N86-22523
SAMANTA, S. C. N86-22451
SAMARSKIY, A. A. N86-22221
SAMOYLENKO, Y. I. N86-21560
SAMUEL, A. G. N86-22111
SARKOS, C. P. N86-21529
SAROHIA, V. N86-21519
SARRAFZADEH, A. N86-21609
SARUBIN, P. V. N86-22267
SATO, G. N86-22092
SATO, S. N86-21664
SAVELSBERGH, M. W. P. N86-22124
SAVITSKIN, G. M. N86-22283
SAZHIN, B. I. N86-21627
SCHAAF, G. N86-21741
SCHACHER, G. E. N86-22063
SCHAFFNER, S. F. N86-22351
SCHERE, K. L. N86-22016
SCHIFF, A. J. N86-21914
SCHILLING, D. L. N86-21734
SCHILZ, W. N86-21792
SCHMIDL, H. N86-21808
SCHMITT, J. H. M. M. N86-22482
SCHMITZ, E. N86-21852
SCHNEIDER, M. E. N86-21910
SCHNEIR, J. N86-21819
SCHNOPPER, H. W. N86-22471
N86-22484
N86-22485
N86-22493
N86-22494
N86-22495
N86-22499
N86-22502
SCHOENFELD, W. P. N86-21733
SCHOMER, P. D. N86-22110
SCHRIJVER, C. J. N86-22492
SCHULTZ, E. R. N86-21540
SCHULTZ, M. H. N86-22186
SCHUSTER, J. N86-21640
SCHWARTZ, A. M. N86-22136
SCHWARZ, H. E. N86-22503
SCHWEITZER, K. N86-21680
SCONING, J. N86-22232
SCULLY, C. N. N86-22398
SEAH, M. P. N86-21813
SEELY, G. R. N86-22090
SEKANINA, Z. N86-22508
SEKATSKIY, S. K. N86-22285
SELLARS, F. M. N86-22010
SENA, J. T. N86-21806
SENUM, G. I. N86-22352
SERIO, S. N86-22469
SEROV, A. V. N86-22264
SETHURAMAN, J. N86-22135
SHAFFER, L. E. N86-21721
SHAM, T. K. N86-22333
N86-22343
N86-22344
N86-22368
N86-22373
SHAMES, A. N86-21662
SHAMIS, D. L. N86-22083
SHANDLING, J. N86-21565
SHAPIRO, P. N86-21714
SHARIPOV, A. K. N86-22259
SHARIR, M. N86-22208
SHAW, G. M. N86-22222
SHEARER, J. W., JR. N86-21782
SHEEN, R. L. N86-21887
SHELDON, W. R. N86-22049
SHERSTEBITOV, V. Y. N86-22286
SHEYNDLIN, A. Y. N86-22405
SHI, X. N86-21789
SHIELDS, N. L. N86-22114
SHUGAEV, F. V. N86-22260
SHULEKIN, S. F. N86-22275
SHUVALOV, V. V. N86-22271
N86-22289
SIDOROV, A. I. N86-22282
SIEGEL, R. B. N86-22000
SIFFERT, P. N86-22497
SILVER, E. H. N86-22494
SILVERMAN, J. P. N86-22332
SIMIC-GLAVASKI, B. N86-21641
SIMMONS, C. J. N86-21693
SIMMONS, J. H. N86-21693
SIMNETT, G. R. N86-22491
SIMON, S. B. N86-22524
SIMONAITIS, L. I. N86-22351
SIMONEU, R. J. N86-21794
SIMONIAN, S. S. N86-21925
SIMPSON, D. G. N86-22246
SIMPSON, R. N86-22157
SIMS, G. R. N86-21829
SIMULESCU, I. N86-22202
SINGH, K. P. N86-22480
SINITSYN, S. V. N86-22415
SIRUTKAITIS, V. N86-22263
SIZMANN, R. N86-21984
N86-21990
SIZOV, V. D. N86-22276
SKIDMORE, G. R. N86-21853
SKUDERA, W. J., JR. N86-21740
SKUPNIEWICZ, C. E. N86-22063
SLINEY, H. E. N86-21682
SLOUGH, G. N86-21819
SLUTZ, R. J. N86-22081
SMILEY, A. N86-21618
SMITH, C. W. N86-21605
SMITH, D. N86-22043
SMITH, H. E. N86-21850
SMITH, J. L. N86-22433
SMITH, L. G. N86-22026
SMITH, N. V. N86-22328
N86-22329
N86-22331
SMITH, P. F. N86-22311
SMITH, P. W., JR. N86-21913
SMITH, R. E. N86-22023
SMITH, R. L. N86-21857
SMOLINSKI, P. J. N86-22203
SNYDER, P. A. N86-22352
SNYDER, W. S. N86-21775
SOBOLYEV, Y. F. N86-22272
SOKOLOV, J. N86-22335
SOKOLOV, S. I. N86-21828
SOKOLOV, Y. V. N86-21977
SOLODOVNIKOVA, L. A. N86-21977
SOLOVEVA, G. S. N86-21515
SOLTIS, S. J. N86-21943
SONDERICKER, D. N86-22334
N86-22335
SONNENFELD, R. N86-21819
SOOVERE, J. N86-21926
SORANTIN, H. N86-22008
SOROKA, A. M. N86-22261
SOUTHWORTH, S. H. N86-21834
SOVEY, J. S. N86-21578
SPADA, G. F. N86-22497
SPANDAU, D. J. N86-22352
SPIRIN, A. N. N86-22415
SPUDIS, P. D. N86-22516
N86-22525
N86-22526
SRINIVASAN, A. V. N86-21889
SRIVASTAVA, J. K. N86-22422
ST.CLAIR, T. L. N86-21685
STABINIS, A. N86-22263
STACK, G. A. N86-22344
STAHLE, C. V. N86-21922
STALEY, J. A. N86-21922
STALNAKER, N. N86-21868
STAMNES, K. N86-22028
N86-22035
STANDIFORD, D. L. N86-21555
N86-21556
STANSBERRY, E. G. N86-22049
STARKE, E. A., JR. N86-21667
STAROSTENKO, I. V. N86-22415
STAUDHAMMER, K. P. N86-21672
STAVROSKIY, D. B. N86-22273
STEEN, A. N86-22040
STEGER, F. N86-22008
STEGMAN, J. N86-22041
STEIGLITZ, K. N86-22187
STEINBERG, D. N86-21712
STEINFELD, J. I. N86-22050
STERN, R. A. N86-22486
N86-22504
STERN, R. M. N86-22095
STETSON, K. A. N86-21817
STEURER, P. M. N86-22081
STEVENSON, D. A. N86-22429
STEWART, J. R. N86-21711
STIEBIG, H. J. N86-21972
STINCHCOMB, W. W. N86-21606
N86-21610
STINTON, D. P. N86-21674
STOCK, J. N86-21662
STOFFEL, N. G. N86-22327
N86-22328
N86-22329
STOLFI, F. N86-21714
STORER, J. A. N86-22212
STOUFFER, D. C. N86-21952
STRASSER, G. N86-22453
N86-22454
STRATE, E. A. N86-21781
STRAUCH, J. N86-22158
STRAUSS, P. R. N86-22087
STREUFERT, S. N86-22437
STRIZHEVSKIY, V. L. N86-21841
STROM, R. G. N86-22467
STRONGIN, M. N86-22333
N86-22336
N86-22337
N86-22338
N86-22339
N86-22340
N86-22341
N86-22342
STRUMPF, H. N86-21870
SUAREZ, S. A. N86-21898
SUHL, H. N86-22423
SUMMERS, L. T. N86-21867
SUN, C. T. N86-21895
SUNDBURG, G. R. N86-21755
SURIYAYOTHIN, N. P. N86-21751
SUTHERLAND, J. C. N86-22356
N86-22357
SUTTER, T. R. N86-21569
SUZUKI, K. N86-21679
SWANN, G. A. N86-22527
SWEET, A. L. N86-21862
SWEZEY, R. W. N86-22437
SWINDEMAN, R. W. N86-21673
SYCHEV, V. V. N86-22405
SYSOEV, N. N. N86-22260
SZYCHER, M. N86-22099

T

TADEUDEMELOLOURENCAO, P. N86-21571
TAKAHASHI, H. N86-22030
TAMASSIA, R. N86-21759
N86-21770
TANAKA, K. N86-21509
TARBELL, T. D. N86-21824
TARRIUS, A. N86-22496
N86-22501
TAUBENBLATT, M. A. N86-21749
TAYLOR, J. K. N86-21649
TAYLOR, L. A. N86-22523
TCHEN, C. M. N86-22056
TELESMAN, J. N86-21661
TENG, Y. C. N86-22047
TENNEY, R. R. N86-22105
TERIELE, H. J. J. N86-22120
TESTARD, O. N86-22496
TEWARI, S. N. N86-21659
TEWARSON, R. P. N86-22218
THAKOOR, A. P. N86-22418
THOMAS, J. M. N86-21961
THOMLINSON, W. N86-22326
THOMPSON, D. L. N86-22426
THOMPSON, J. A. N86-21851
THOMPSON, S. N86-22158
THURSTON, A. N86-21868
TIEE, J. J. N86-22350
TIERNEY, E. N86-22421
TIGIN, D. V. N86-21828
TIMOSHENKO, V. I. N86-21512
TIWARI, S. N. N86-21798
TOKEDEMIR, F. N86-22477
TOKSOEZ, M. N. N86-22044
TOLLAR, E. S. N86-22213
TOLLIS, I. G. N86-21770

TOMAI, M. N86-22085
TOMASINI, E. P. N86-21837
TOMEI, B. A. N86-22026
TOMLINSON, G. N86-22453
N86-22454
TOMPKINS, S. S. N86-21598
TOMURA, S. N86-21628
N86-21629
TONG, Y. L. N86-22162
TOROPKIN, G. N. N86-22257
TOWNSEND, T. N86-22074
TRAHAN, J. L. N86-22142
TRETHEWEY, B. N86-21618
TRIESCH, K. N86-21524
TRUDELL, R. W. N86-21930
TRUONG, L. V. N86-21755
TSAREV, V. M. N86-22267
TSENDIN, L. D. N86-22294
TSENINA, I. S. N86-22270
TSITSIKLIS, J. N. N86-22237
TSUI, E. T. N86-21739
TUNIK, Y. V. N86-22265
TURNER, E. R. N86-21546
TZOU, H. S. N86-21914

U

UCKAN, N. A. N86-22411
ULMER, M. P. N86-22491
UMOV, A. P. N86-22294
UNGAR, E. E. N86-21907
UNROE, M. R. N86-21676
USAB, W. J., JR. N86-21505
USINGER, W. R. N86-22086
USKOV, A. V. N86-22299
USPENSKII, M. N. N86-22415
USTINOV, N. D. N86-22270
UZHINOV, B. M. N86-22287

V

VALOVCIN, P. N86-22441
VANARK, W. N86-21982
VANDELUNE, J. N86-22120
VANFELDT, W. J. N86-22065
VANMILL, J. N86-22123
VANWINSSEN, J. C. N86-21865
VARGISH, T. N86-22100
VASILYAUSKAS, V. N86-22263
VASKOVSKIY, Y. M. N86-22270
VEDULA, K. N86-21656
VENTURA, G. N86-22497
VENTURINI, E. L. N86-21698
VERDON, J. M. N86-21505
VERNIN, J. N86-22034
VERNON, W. N86-22423
VERNOT, E. H. N86-22097
VEST, K. F. N86-21731
VIEBROCK, J. H. N86-22054
VIEIRA, J. R. N86-22487
VIOTTI, R. N86-22472
VITT, B. N86-21988
VOGEL, D. J. N86-21956
VOIGT, C. N86-21985
VOISHCHEV, V. S. N86-21627
VOLKOV, Y. D. N86-22296
VOLLRATH, K. N86-21815

W

WADA, B. K. N86-21903
WAKAI, M. N86-22084
N86-22085
WALDMAN, J. M. N86-22017
WALDRON, W. L. N86-22458
WALDROP, G. P. N86-22167
WALKER, W. J. N86-21921
WALL, W. A. N86-21850
WALLACE, B. A. N86-22356
WALLACE, C. E. N86-21905
WALLCRAFT, A. N86-22074
WALTERS, E. A. N86-22360
N86-22361
WALTON, D. M. N86-22504
WANG, D. S. N86-21615
WANG, J. S. N86-21704
WANG, W. N86-22416
WARD, A. L. N86-21777
WARD, J. D. N86-22077
WARLAUMONT, J. M. N86-22332
WARMAN, J. C. N86-21973
WARREN, J. R. N86-21962
WARREN, P. H. N86-22528
WARWICK, A. N86-22384
WATSON, J. T. N86-21830
WATTERS, D. M. N86-21945
WATTS, D. R. N86-22076
WAYNE, R. P. N86-22036
WEBB, K. J. N86-21763
WEERASOORIYA, T. N86-21965
WEIGLE, G. R. N86-21671
WEINER, M. N86-21780
WEITZ, E. N86-21588
WELLS, A. N86-22505
WELSH, C. J. N86-21581
WENG, S. L. N86-22333
WENTWORTH, S. J. N86-22513
WERRELL, K. P. N86-21538
WESNER, D. N86-22333
WESTERGAARD, N. J. N86-22484
N86-22485
N86-22489
N86-22493
N86-22494
WESTON, R. E. N86-22353
WESTON, R. E., JR. N86-22350
WHELAN, D. S. N86-22149
WHELAN, J. A. N86-21998
WHITCOMB, G. P. N86-22490
WHITE, C. N86-21931
WHITE, M. G. N86-22358
N86-22360
N86-22361
N86-22362
WHITEMAN, C. D. N86-22013
WHITESIDES, G. M. N86-22425
WHITNEY, T. E. N86-22148
WICKNER, R. N86-22092
WICKRAMAARATCHI, M. A. N86-22353
WIEDEMANN, J. N86-22115
WIGHTMAN, J. P. N86-21612
WILHELMS, D. E. N86-22529
N86-22530
WILKES, G. L. N86-21613
WILLIAMS, F. L. N86-21536
WILLIAMS, G. P. N86-22364
N86-22365
N86-22366
N86-22367
N86-22369
WILLINGALE, R. N86-22505
WILLIS, P. B. N86-21584
WILLSKY, A. S. N86-22105
N86-22219
WILSDORF, H. G. F. N86-21668
WILSON, D. N86-22079
WILSON, D. A. N86-21962
WILSON, M. D. N86-21546
WINKLER, I. N86-22050
WINTER, C. J. N86-21985
WISE, P. L. N86-22080
WITT, C. N86-22104
WITT, G. N86-22027
N86-22028
N86-22041
WOELLER, F. H. N86-21859
WOJTOWICZ, J. J. N86-22311
WOMELSDUFF, J. E. N86-21713
WONG, J. N86-22344
WOODRUFF, S. D. N86-22081
WORKMAN, G. L. N86-21564
WRIGHT, J. E. N86-22070
WRIGHTMAN, E. M. N86-21642
WU, S. N86-22334
N86-22335
WYNN, L. K. N86-21969

X

XIA, N. N86-21522

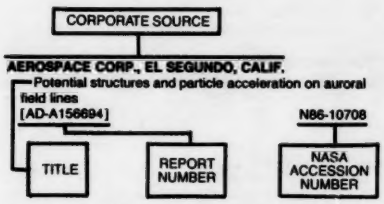
Y

YAMSHCHIKOV, V. A. N86-22270
YAN, S. L. N86-22417
YANG, B. X. N86-22373
YANG, Q. Y. N86-22354
YANG, W. N86-21880
YANKAUSKAS, A. N86-22263
YAZDY, M. R. N86-21745
YAZIV, D. N86-21879
YEAGER, E. B. N86-21641
YEGOROV, K. D. N86-22271
YELISEYEV, P. G. N86-22274
YEROFEEV, V. I. N86-22293
YILGOR, I. N86-21613
YIN, X. N86-21522
YOST, W. T. N86-22307
YOU, Y. H. N86-21616
YOUNG, A. T. N86-21699
YOUNG, G. W. N86-21787
YOUNG, T. H. N86-21909
YU, C. F. N86-22355
YU, F. T. S. N86-22397
YU, J. N86-21522
YU, T. K. E. N86-21762
YU, Z. N86-21750
YUFEROV, V. B. N86-22296
YUKHVID, V. I. N86-21633
YURCHUK, S. V. N86-22269

Z

ZAMLUTTI, C. J. N86-22058
ZARYANKIN, A. Y. N86-21515
ZEDALIS, M. S. N86-21650
ZEHENTNER, J. N86-21752
ZENCHENKO, S. A. N86-22275
ZENKEVICH, V. B. N86-22405
ZHAVORONKOV, M. I. N86-22270
ZIMMERMAN, J. G. N86-21586
ZIMMERMAN, R. E. N86-21942
ZINKO, H. N86-21989
ZOLCINSKI, M. C. N86-22486
ZOU, Q. N86-22416
ZUBOV, V. V. N86-22272
ZUBRILIN, N. G. N86-22269
ZVIAGIN, Y. V. N86-21632

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ADAPTIVE SENSORS, INC., SANTA MONICA, CALIF.
An algebraic syndrome decoding technique for certain convolutional codes
[AD-A162636] N86-22177

AERODYNE RESEARCH, INC., BILLERICA, MASS.
Bimodal optical computer
[AD-A161399] N86-22187

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Measurements of the symmetric aerodynamic coefficients for flat faced cylinders with strakes in the angle of attack regime 70 to 90 deg for transonic speed
[FFA-TN-1985-39] N86-21523
The evolution of a wave train in a three-dimensional boundary layer
[FFA-TN-1985-54] N86-21809
Measurement of noise from airplanes traveling at heights 3500 to 6000m
[FFA-TI-AU-2168] N86-22312

AERONAUTICAL RESEARCH LABS., MELBOURNE (AUSTRALIA).
Comparison of airborne data acquisition systems at ARL (Aeronautical Research Laboratories)
[AD-A161664] N86-21537
A conditional sampling module for the TSI laser Doppler anemometer counter processor
[AD-A161555] N86-21823

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536

AEROSPACE CORP., EL SEGUNDO, CALIF.
Control of missile dispersion via roll rate modulation
[AD-A162542] N86-21565
Radiant-energy penetration effect in the thermal-diffusivity flash technique for layered and porous polymers
[AD-A162508] N86-21690
Behavior of singlet oxygen in the oxygen-iodine transfer laser
[AD-A161390] N86-21843
X-ray microbursts and VLF chorus
[AD-A162531] N86-22049
Analysis of a linear antenna two wavelengths long: Consideration of options
[AD-A162799] N86-22222

AIR FORCE AERO PROPULSION LAB., WRIGHT-PATTERSON AFB, OHIO.
Aircraft mishap fire pattern investigations
[AD-A161094] N86-21528

AIR FORCE ARMAMENT LAB., EGLIN AFB, FLA.
An eight-inch diameter, heavily confined card gap test
[AD-A161557] N86-21705

AIR FORCE ENGINEERING AND SERVICES CENTER, TYNDALL AFB, FLA.
Rubber removal specification development
[FAA/PM-85/33] N86-21555
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
A global reference atmosphere from 18 to 80 km, Air Force surveys in geophysics
[AD-A162499] N86-22048
Spectroscopic, kinetic, and dynamic experiments on atmospheric species
[AD-A162691] N86-22050

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Development of a computerised method of determining aircraft maintenance intervals
[AD-A161339] N86-21500
Jet engine operating and support cost estimating relationship development
[AD-A161683] N86-21547
A synthesis of research on color, typography and graphics as they relate to readability
[AD-A161340] N86-21820
Personality type analysis of Air Force Institute of Technology School of Systems and Logistics graduate degree 85S class using Myers-Briggs Type-Indicator
[AD-A161053] N86-22107
Decision support system for ASD (Aeronatical Systems Division) program managers
[AD-A161690] N86-22137
A microcomputer program for the solution of learning curve computations
[AD-A161648] N86-22163
A guide to promote the use of electronic spreadsheets among Air Force personnel
[AD-A161682] N86-22164
An assessment of Ada's suitability in general purpose programming applications
[AD-A161715] N86-22165
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408
An analysis of foreign source dependence for critical microcircuits of USAF avionics components
[AD-A161311] N86-22436
Initial and qualification operational test and evaluation in the acquisition of non-major communication systems
[AD-A161729] N86-22439
Risk and the right model
[AD-A161757] N86-22440
A methodology for applying bar code technology to Aircraft Maintenance Unit support sections
[AD-A161783] N86-22441
Applications of computers as an aid to decision-making in Air Force System Program Offices
[AD-A161784] N86-22442
Use of space dependent on development of space law
[AD-A161397] N86-22449

AIR FORCE ROCKET PROPULSION LAB., EDWARDS AFB, CALIF.
A diffuser heat transfer and erosion code
[AD-A162436] N86-21802

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Acta mechanica sinica (Selected articles)
[AD-A162726] N86-21522
The 3rd National Conference on Metallic Powder Study was held in An-Shan
[AD-A162408] N86-21669
Defect inspection of solid fuel propellant cylinders by means of laser holographic techniques
[AD-A162746] N86-21710
Lagrangian boundary equation and unsteady separation of elliptical cylinder at angle of attack
[AD-A162407] N86-21801
An opticoacoustic correlation spectral analyzer
[AD-A162406] N86-21828
Theoretical prerequisites for the possible use of bacteria which split organophosphates in order to increase the yield of nutrient yeast and its nitrogen and phosphorous content
[AD-A161811] N86-22083
On conservative difference schemas
[AD-A162798] N86-22221
A pulsed magnetohydrodynamic generator with a superconducting magnetic system
[AD-A161812] N86-22405

AIR FORCE WRIGHT AERONAUTICAL LABS., WRIGHT-PATTERSON AFB, OHIO.
F100 fuel sampling analysis
[AD-A161667] N86-21707
Investigation of sheath phenomena in electronegative glow discharges
[AD-A162416] N86-21772
Vibration Damping 1984 Workshop Proceedings
[AD-A152547] N86-21883
Fractional calculus to represent complex modulus N86-21885
Damping measurement by dynamic stiffness methods N86-21902
Air force technical objective document, flight dynamics laboratory plans for fiscal year 1987
[AD-A162792] N86-22443

AIR UNIV., MAXWELL AFB, ALA.
The evolution of the cruise missile
[AD-A162646] N86-21538

AIRESEARCH MFG. CO., TORRANCE, CALIF.
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[PB86-105079] N86-21870

AKRON UNIV., OHIO.
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[AD-A162775] N86-21696

ALABAMA UNIV., HUNTSVILLE.
Drop tube technical tasks
[NASA-CR-178741] N86-21564

ALASKA UNIV., FAIRBANKS.
Development of a geomagnetic storm prediction scheme
[AD-A161651] N86-22535

ALLIED BENDIX AEROSPACE, MISHAWAKA, IND.
Hardware test program for evaluation of baseline range/range rate sensor concept
[NASA-CR-178710] N86-22129

ALPHATECH, INC., BURLINGTON, MASS.
Specification and preliminary validation of IAT (Integrated Analysis Techniques) methods: Executive summary
[AD-A162509] N86-21736

AMERICAN CHEMICAL SOCIETY, SPRINGFIELD, VA.
Ultrasonic model investigation of the effects of lateral heterogeneities on seismic surface wave propagation and scattering
[AD-A161720] N86-22044

AMSTERDAM UNIV. (NETHERLANDS).
Set theory and topology N86-22123

ARGONNE NATIONAL LAB., ILL.
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios
[DE86-000789] N86-21834

ARIZONA STATE UNIV., TEMPE.
Measured damping of shuttle acoustic test structures N86-21905
Hadley Rille, lava tubes and mare volcanism at the Apollo 15 site N86-22516

ARIZONA UNIV., TUCSON.
Characterization of a charge injection device camera system for spectrochemical measurements
[AD-A162472] N86-21829
Visual perception in correlated noise N86-22106
Complex mixture analysis by photoionization mass spectrometry with a VUV hydrogen laser source
[AD-A162401] N86-22320

Characterization of the General Electric CID-17 as a detector for plasma emission spectrometry
[AD-A162415] N86-22406

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, WATERVLIET, N. Y.
The electroplating of laminated chromium
[AD-A162751] N86-21671
Machinability data bases for metal cutting
[AD-A161646] N86-21860
Elastic-plastic loading and unloading in a thick tube with kinematic hardening theory
[AD-A161733] N86-21958

ARMY COMBAT SYSTEMS TEST ACTIVITY (PROVISIONAL), ABERDEEN PROVING GROUND, MD.
Development of improved broadband cable system communications
[AD-A161559] N86-21766

ARMY CONSTRUCTION ENGINEERING RESEARCH LAB., CHAMPAIGN, ILL.
The role of vibration and rattle in human response to helicopter noise
[AD-A162486] N86-22110
Development and use of the Life Cycle Cost In Design computer program (LCCID)
[AD-A162522] N86-22174

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Spectral analysis of Columbia River estuary currents
[AD-A161609] N86-22073

ARMY MILITARY PERSONNEL CENTER, ALEXANDRIA, VA.
An adaptive mesh algorithm for solving systems of time dependent partial differential equations
[AD-A161822] N86-22215

ARMY RESEARCH INST. OF ENVIRONMENTAL MEDICINE, NATICK, MASS.
Heat acclimatization developed during summer running in northeastern United States
[AD-A162728] N86-22102
An automated system for comprehensive assessment of visual field sensitivity
[AD-A162755] N86-22104

ARMY RESEARCH OFFICE, RESEARCH TRIANGLE PARK, N. C.
Effect of flow oscillations on cavity drag and a technique for their control
[NASA-CR-176652] N86-21519

ATLANTA UNIV., GA.
Investigation of perturbation techniques for nonlinear difference equations and other related problems
[DE86-001162] N86-22224

AUBURN UNIV., ALA.
Research projects of the Water Resources Research Institute during FY 1983
[PB86-101235] N86-21973
Random integral representations for classes of limit distributions similar to Levy class L(O)
[AD-A161413] N86-22235
Surface analysis of space telescope material specimens
[NASA-CR-178712] N86-22460

AUSTRIAN SOLAR AND SPACE AGENCY, VIENNA.
Solar energy: One decade of research and application, review and outlook N86-21997

AUTOMATED SCIENCES GROUP, INC., SILVER SPRING, MD.
General aviation pilot and aircraft activity survey
[AD-A161665] N86-21530

B

B AND M TECHNOLOGICAL SERVICES, INC., CAMBRIDGE, MASS.
State-of-the-art review on composite material fatigue/damage tolerance
[FAA/CT-85/7] N86-21615

BALL AEROSPACE SYSTEMS DIV., BOULDER, COLO.
Radiation-hard breadboard star tracker
[AD-A162777] N86-21566
Radiation-hard breadboard star tracker. Attachment 1
[AD-A162778] N86-21567

BATTELLE COLUMBUS LABS., OHIO.
Prototype salvage foaming system
[AD-A161499] N86-21688
Burner technology bulletin: Control of NOx emissions from residential gas appliances
[PB86-103892] N86-21873

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Green River air quality model development. VALMET: A valley air pollution model
[PB86-104106] N86-22013

BELL TELEPHONE LABS., INC., MURRAY HILL, N. J.
Metal-insulator transition on the Ge(001) surface N86-22327
Surface states on simple metal surfaces N86-22328
Angle resolved photoemission studies of electronic structure N86-22329

BERKELEY RESEARCH ASSOCIATES, INC., CALIF.
Development of research tools to study structure and evolution in the intermediate altitude regime
[AD-A162707] N86-22376

BERN UNIV. (SWITZERLAND).
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BIONETICS CORP., HAMPTON, VA.
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[NASA-CR-178062] N86-22306

BIRMINGHAM UNIV. (ENGLAND).
Ion and electron interactions of atmospheric importance
[AD-A161619] N86-22043

BOEING AEROSPACE CO., KENT, WASH.
Specification technology guidelines
[AD-A162655] N86-22178

BOEING AEROSPACE CO., SEATTLE, WASH.
Application of damping to improve reliability of IUS-type satellite equipment: RELSAT Program N86-21921

BOEING CO., SEATTLE, WASH.
Operation REDWING, Project 5.2, in-flight participation of a B-52
[AD-A995286] N86-21536
Beam dampers for skin vibration and noise reduction in the 747 N86-21917

BOEING MILITARY AIRPLANE DEVELOPMENT, SEATTLE, WASH.
Integrated damped fuselage structure N86-21918

BOGAZICI UNIV., ISTANBUL (TURKEY).
EXOSAT CMA observations of X0512-401 = NGC 1851 N86-22477

BOLT, BERANEK, AND NEWMAN, INC., CAMBRIDGE, MASS.
Structural damping potential of waveguide absorbers N86-21907
Segmenting and mechanical attachment of constrained viscoelastic layer damping treatments for flexural and extensional waves N86-21913

BOSTON COLL., CHESTNUT HILL, MASS.
The effect of contacts on the counting characteristics of heavily doped n-type cadmium telluride N86-21746
Electronic energy transfer among complex molecules N86-22316

BOSTON UNIV., MASS.
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[AD-A161513] N86-21521

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[BLL-RISLEY-TR-5237-(9091.9F)] N86-21877

BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Safeguards instrumentation: A computer-based catalog, second edition
[DE86-000840] N86-21835
Activity of the National Synchrotron Light Source (NSLS)
[BNL-51840] N86-22326
Beam line U5: (FEL and diagnostic line) N86-22330
Undulator based beamline studies on U5 N86-22331
Photon energy dependent branching ratios of the inner valence satellites in the photoemission of solid ethylene N86-22336
Studies of Gd clusters on carbon: The question of initial state or final state effects N86-22337
Core level shift of Pt clusters in Si02: The transition from metallic to insulating behavior N86-22338
Photon desorption studies of synchrotron materials N86-22339
The adsorption of carbon monoxide on palladium films N86-22340
Ni, Pd and Pt overlayers on Ta(110) N86-22341
Studies of the Ta(110) surface and hydrogen on Ta(110) N86-22342
Carbon K-edge X-ray absorption spectroscopic studies of structure and electronic properties of hydrocarbons adsorbed on Ni crystal surfaces N86-22343
Photoionization of laser-excited sodium atoms using synchrotron radiation N86-22349
UV-VUV circular dichroism spectrometer N86-22352
The lifetime of the fluorescent excited state of solid, liquid and vapor phase cyclohexane N86-22353
U9B: Ultraviolet biophysics N86-22357
Application of vacuum ultraviolet photon beams to transients produced by discharge-flow tube sources: Photoionization efficiency spectrum of O2(1 delta g) N86-22359
Measurement of the dissociation energies of gas phase neutral dimers by a photoionization technique N86-22360
Photoelectron spectroscopy of autoionizing Rydburg states in small molecules N86-22362
X-ray holography experiments on the U15 beam line N86-22371

BROWN UNIV., PROVIDENCE, R. I.
Shear stress concentration near the edge of a thin film deposited on a substrate N86-21880

C

CABOT CORP., INDIANAPOLIS, IND.
Use of skin damping treatments to control airframe dynamic response for interior noise control N86-21919

CALIFORNIA INST. OF TECH., PASADENA.
Experiments on entrainment, mixing and chemical reactions in turbulent jets at large Schmidt number N86-21503
Experimental study of shear flows and convective heat transfer characteristics of granular materials N86-21785
An experimental study of convective heat transfer, friction, and rheology for non-Newtonian fluids: Polymer solutions, suspensions of fibers, and suspensions of particulates N86-21786
Heat release effects in a turbulent, reacting shear layer N86-21788
Characterization of reactants, reaction mechanisms and reaction products in atmospheric water droplets: Fog, cloud, dew and rain water chemistry
[PB86-107976] N86-22017
Advanced Technology Unit Training and Management System (ATUTMS). User's guide
[NASA-CR-176643] N86-22130
Combining computation with geometry N86-22145
Hierarchical composition of VLSI circuits N86-22148
ANIMAC: A multiprocessor architecture for real time computer animation N86-22149
Solar photospheric and coronal abundances from solar energetic particle measurements N86-22532

CALIFORNIA UNIV., BERKELEY.
Two-dimensional strain cycling in plasticity
[AD-A161666] N86-21665
Molecular and biological properties of an immunopotentiating complex polysaccharide adjuvant produced by a gliding bacterium
[AD-A162664] N86-22086
The application of reflection gratings to a large area X-ray spectroscopy mission: A discussion of scientific requirements and various design options N86-22498

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Morphological stability of continuous intergranular phases
[DE86-001483] N86-21701
Improvements in the weldability of a superconductor sheath material
[DE86-000748] N86-21867
Theoretical study of intermolecular energy transfer of an electronically excited diatomic molecule by atom impact: He((1)S) + H2(B (1)(SIGMA)(+) /sub u/)
[DE86-001480] N86-22322
Flow of nuclear matter
[DE86-001484] N86-22384

CALIFORNIA UNIV., IRVINE.
Methods of conceptual clustering and their relation to numerical taxonomy
[AD-A160221] N86-22191

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[AD-A161558] N86-22097

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Stress-strain behavior and failure of uniaxial composites in combined compression and shear - 1
[AD-A161772] N86-21620
A new implementation of the pipeline analog-to-digital conversion technique N86-21745
High repetition rate electron beam RF-acceleration and sub-millimeter wave generation via a free electron laser
[AD-A162791] N86-22377
The origin of pristine KREEP: Effects of mixing between ur KREEP and the magmas parental to the MG-rich cumulates N86-22528

CALIFORNIA UNIV., SAN DIEGO.
A study of surface properties of superconducting materials for high power microwave applications
[AD-A161740] N86-22423
Use of interplanetary scintillation for Earth space environment and geomagnetic forecasting
[AD-A161621] N86-22509
CALIFORNIA UNIV., SAN DIEGO, LA JOLLA.
Advanced clinical research in shock and trauma
[AD-A162730] N86-22103
CALIFORNIA UNIV., SANTA BARBARA.
A tunneling microscope for operation in air or fluids
[AD-A161325] N86-21819
Electron acceleration by laser fields in a gas
[DE86-000983] N86-22380
Squeezable tunnel junctions
[AD-A161537] N86-22419
CALSPAN CORP., BUFFALO, N. Y.
A chamber investigation of the IR and visible wavelength obscuration properties of pyrotechnically generated smokes
[AD-A161753] N86-22046
CALSPAN FIELD SERVICES, INC., ARNOLD AFS, TENN.
Test fixture effects in vibration tests of rocket motors
[AD-A161403] N86-21581
CAMBRIDGE UNIV. (ENGLAND).
The X-ray background N86-22463
CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
Gallium Arsenide structures and interfaces formed by molecular beam epitaxy N86-21747
Calibration and use of a light stripe range sensor mounted on the hand of a robot
[AD-A162441] N86-21863
Accurate trajectory control of robotic manipulators
[AD-A162561] N86-21865
Research on friction damping in jet engines at Carnegie-Mellon University N86-21892
DP format of the drawing files
[AD-A162440] N86-22139
The use of quantitative databases in Aladin, an alloy design system
[AD-A162555] N86-22176
CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Spectroscopic and electrochemical studies of transition-metal tetrasulfonated phthalocyanines. Part 6: The adsorption of iron tetrasulfonated phthalocyanine on single crystal silver electrodes
[AD-A161640] N86-21641
Effect of boron on tensile properties of B2 BeAl
[NASA-CR-175074] N86-21656
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[CWI-NEWSLETTER-2] N86-22117
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Software development: Science or patchwork N86-22119
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CWI Newsletter, no. 7, June 1985
[CWI-NEWSLETTER-7] N86-22121
Vehicle routing and computer graphics N86-22124
CWI Newsletter, no. 6, March 1985
[CWI-NEWSLETTER-6] N86-22154
The Pythagoras tree as a Julia set N86-22155
Mathematical libraries in Ada N86-22156
CENTRAL ELECTRICITY GENERATING BOARD, LONDON (ENGLAND).
Using the nuclear gamma resonance method to study radiation defects in ferrites
[BLL-CE-TRANS-8220-(9022.090)] N86-22415
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, VERRIERES-LE BUISSON (FRANCE).
Bolometers as spectrometers for X-ray astronomy N86-22496
CHARLES F. KETTERING RESEARCH LAB., YELLOW SPRINGS, OHIO.
Particulate models of photosynthesis
[DE86-001625] N86-22090
CHICAGO UNIV., ILL.
Temperature dependence of the work function of Cu layers on a W(110) plane
[AD-A162573] N86-22428
CINCINNATI UNIV., OHIO.
Anisotropic constitutive model for nickel base single crystal alloys: Development and finite element implementation
[NASA-CR-175015] N86-21952
CITY COLL. OF THE CITY UNIV. OF NEW YORK.
Spread spectrum acquisition and tracking
[AD-A162442] N86-21734
Optical acquisition, image and data compression
[AD-A161650] N86-22393
CLEMSON UNIV., S.C.
Development of a system to produce semiconductor insulator multi-layer structures
[AD-A162750] N86-22430
COLORADO STATE UNIV., FORT COLLINS.
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[PB86-101367] N86-21974
COLORADO UNIV., BOULDER.
Vortical flows about oscillating airfoil with surface suction N86-21502
Analysis of nitric oxide fluorescence bands from high latitude rocket observations of the thermospheric dayglow N86-22018
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22081
COLUMBIA UNIV., NEW YORK.
Ground response in alluvial basins due to seismic disturbances
[AD-A162467] N86-22047
Algorithms for nonlinear programming
[AD-A161746] N86-22138
Finite element method analysis of nonlinear continua using stochastic equivalent linearization technique N86-22202
VUV optical properties of cadmium dimethyl N86-22354
Photodissociation of vinyl cyanide N86-22355
Preliminary studies on the acetylcholine receptor by vacuum ultra-violet circular dichroism spectroscopy N86-22356
X-ray polarimetry on XMM N86-22500
COMMISSARIAT A L'ENERGIE ATOMIQUE, SACLAY (FRANCE).
A multiplex coding imaging spectrometer for X-ray astronomy N86-22501
COMMITTEE ON SCIENCE AND TECHNOLOGY (U. S. HOUSE).
NASA's long range plans
[GPO-55-035] N86-22435
Authorizing appropriations for Landsat commercialization
[HR-REPT-99-177] N86-22448
COMPUTER SCIENCES CORP., HAMPTON, VA.
Airport-Noise Levels and Annoyance Model (ALAMO) user's guide
[NASA-TM-87695] N86-22304
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
COMPUTER SYSTEMS MANAGEMENT, INC., ARLINGTON, VA.
Design, development, and installation of a two-node, color video-teleconferencing system for the US Navy
[AD-A161614] N86-21731
CONSIGLIO NAZIONALE DELLE RICERCHE, BOLOGNA (ITALY).
Room temperature solid state spectrometer for X-ray astronomy N86-22497
COPENHAGEN OBSERVATORY (DENMARK).
High resolution X-ray spectroscopy of clusters of galaxies N86-22465
EXOSAT observations of the poor cluster of galaxies 2A0335+096 N86-22484
CORNELL UNIV., ITHACA, N.Y.
Low cost management of replicated data
[AD-A162771] N86-22447
CRANFIELD INST. OF TECH., BEDFORD (ENGLAND).
A programme of research into the aerodynamics, stability and control characteristics of a combat aircraft having a forward swept wing N86-21533
CSA ENGINEERING, INC., PALO ALTO, CALIF.
Finite element design of viscoelastically damped structures N86-21910

D

DANISH SPACE RESEARCH INST., LYNGBY.
Instrumentation for X-ray spectroscopy N86-22471
The Hyades: EXOSAT broad band spectroscopy N86-22485
A thin foil high throughput X-ray telescope N86-22489
The XMM imaging Bragg spectrometer with a doubly curved crystal N86-22493
Measurements of intrinsic width and mosaicity of test crystals with a novel four-crystal X-ray spectrometer N86-22494
Measurements of surface scattering from mirrored surfaces using a triple axis X-ray spectrometer N86-22495
A multiwire proportional counter for low energy X-ray imaging N86-22499
Objective crystal spectrometer (OXS) for imaging extended cosmic X-ray sources N86-22502
DARESBURY NUCLEAR PHYSICS LAB. (ENGLAND).
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios
[DE86-000789] N86-21834
DAYTON UNIV., OHIO.
Effect of temperature, humidity, and loading rate on the shear properties of tactical shelter core materials
[AD-A162793] N86-21697
Multidimensional high-resolution gas chromatographic investigations of hydrocarbon fuels and various turbine engine fuel precursors
[AD-A162660] N86-21709
Shock fracture and recompaction of ceramics N86-21879
On vibration damping analysis using the finite element method N86-21911
Results of finite element analysis of damped structures N86-21912
Design evaluation and field qualification of a damping system for an auxiliary power unit N86-21915
Overload effects in sustained load crack growth in Inconel 718
[AD-A162739] N86-21965
DEFENCE AND CIVIL INST. OF ENVIRONMENTAL MEDICINE, DOWNSVIEW (ONTARIO).
Selection of a man-modelling CAD (Computer-Aided Design)
[AD-A161342] N86-22159
DEFENCE RESEARCH ESTABLISHMENT ATLANTIC, DARTMOUTH (NOVA SCOTIA).
GETWRD package update: New features and modifications to the GETWRD package
[AD-A162698] N86-22179
DEFENCE RESEARCH ESTABLISHMENT SUFFIELD, RALSTON (ALBERTA).
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[AD-A162631] N86-21803
DEFENCE RESEARCH ESTABLISHMENT VALCARTIER (QUEBEC).
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[AD-A162519] N86-21589
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[DRIC-T-7632] N86-21752
DEFENSE NUCLEAR AGENCY, WASHINGTON, D.C.
Chemistry of MOS-LSI radiation hardening
[NASA-CR-176651] N86-21636
DEFENSE SYSTEMS MANAGEMENT SCHOOL, FORT BELVOIR, VA.
Artificial intelligence and its use in cost type analyses with and example in cost performance measurement
[AD-A161817] N86-22168
DELAWARE UNIV., NEWARK.
Delamination growth in composite materials
[NASA-CR-178066] N86-21618
A search for outflows from X-ray bright points in coronal holes
[NASA-CR-176647] N86-22458
DEPARTMENT OF THE AIR FORCE, WASHINGTON, D.C.
Robotic refueling system for tactical and strategic aircraft
[AD-D011980] N86-21540
Dual material exhaust nozzle flap
[AD-D011998] N86-21548
A new NDE method for coated carbon-carbon composites
[AD-D011978] N86-21625
Thermosetting arylether compounds and their synthesis
[AD-D012025] N86-21676
Radar-clutter simulator
[AD-D011992] N86-21741
Electrical cone connector
[AD-D011982] N86-21781
Claw grip contact probe for flat packs
[AD-D011997] N86-21782
Computer Controller Optical Surfacing (CCOS) lap pressure control system
[AD-D011985] N86-21805
Universal wavefront sensor apparatus
[AD-D011983] N86-21830
Apparatus for transmitting data from high speed rotors
[AD-D011991] N86-21831
Novel methods for tuning free electron lasers to multiple wavelengths
[AD-D011986] N86-21847
Repetitively pulsed Q-switched chemical oxygen-iodine laser
[AD-D011989] N86-21848

Computer controlled lead forming
[AD-D011984] N86-22183
Hybrid single crystal optic fibers by growth solution
[AD-D011979] N86-22396
A real-time programmable optical correlator
[AD-D011990] N86-22397
Infrared sensor target
[AD-D011996] N86-22398
Synthetic aperture multi-telescope tracker apparatus
[AD-D011981] N86-22506

DEPARTMENT OF THE ARMY, WASHINGTON, D. C.
Electrolyte for lithium-inorganic non-aqueous rechargeable cell system and rechargeable cell system including said electrolyte
[AD-D011976] N86-21647
Method of chemically polishing quartz crystal blanks
[AD-D011975] N86-21722
SAW (Surface Acoustic Wave) transition detector for PSK (Phase Shift Keying) signals
[AD-D011974] N86-21740
Optically triggered bulk device gunn oscillator
[AD-D011977] N86-21780

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A direct method to calculate disturbance fields of moving bodies at subsonic speeds in compressible media
[DFVLR-FB-85-52] N86-21812
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[DFVLR-FB-85-56] N86-22399

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, COLOGNE (WEST GERMANY).
Investigation of Ferri instability in supersonic inlets
[DFVLR-FB-85-53] N86-21524

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[DFVLR-MITT-85-14] N86-21558

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Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[DFVLR-FB-85-50] N86-21541
A contribution to the digital compensation of periodic disturbances with frequencies in bounded intervals
[DFVLR-FB-85-55] N86-21553
Investigation of the information content of LANDSAT Thematic Mapper (TM) and SPOT multiband image data using simulated image data of the Freiburg region
[DFVLR-FB-85-49] N86-21972
The icing research aircraft DO28, D-IFMP of DFVLR, and its measuring equipment
[DFVLR-MITT-85-12] N86-22064

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[NASA-CR-176654] N86-22251

DUKE UNIV., DURHAM, N. C.
Finding critical sets
[AD-A161368] N86-22207
A study of orientational ordering in solid deuterium N86-22315
Radiative neutron capture by deuterum N86-22325

E

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[AD-A161521] N86-21822

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Core level shifts and electronic structure of Cu3Au N86-22334
Angle resolved photoemission and band structure of Cu3Au N86-22335

F

FAILURE ANALYSIS ASSOCIATES, PALO ALTO, CALIF.
Fracture control for fixed offshore structures
[AD-A162507] N86-21961

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[AD-A161366] N86-21662

FEDERAL AVIATION ADMINISTRATION, ATLANTIC CITY, N.J.
Aircraft interior panel test criteria derived from full-scale fire tests
[AD-A161637] N86-21529

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Controlled impact demonstration airframe bending bridges N86-21943

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Evaluation of a passenger mask modified with a rebreather bag for protection from smoke and fumes
[AD-A162473] N86-22116

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[AD-A161392] N86-22135
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[AD-A162757] N86-22182
On the limit behavior of a multi-compartment storage model with an underlying Markov chain. Part II: With normalization
[AD-A161661] N86-22213
Piecewise geometric estimation of a survival function
[AD-A161322] N86-22230
Efficiency loss with the Kaplan-Meier estimator
[AD-A161341] N86-22232

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[AD-A162740] N86-21693
Composite material damping using impulse technique N86-21895

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[DE86-001662] N86-21702

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Damping in support structures for satellite equipment reliability: RELSAT N86-21922
Flexible structure control in the frequency domain N86-21929
Transformation toughened ceramics for the heavy duty diesel engine technology program, phase 2
[NASA-CR-175054] N86-22451

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[AD-A161338] N86-21573
Photoemission study of metal-doped beta-boron thermoelectric materials N86-22344

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[NASA-CR-174827] N86-21546
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[AD-A161453] N86-21971
The materials and formation of the imbrium basin N86-22525
The Apennine Bench Formation revisited N86-22526
Some observations on the geology of the Apollo 15 landing site N86-22527

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POLYGON: An interactive program for constructing and editing the geometries of polygons using a color graphics terminal
[DE86-001419] N86-22185
Geologic setting of the Apollo 15 landing site N86-22529
Selection of the Apollo 15 landing site N86-22530

GEORGE WASHINGTON UNIV., WASHINGTON, D.C.
A graphical debugger for concurrent Ada programs N86-22147
Investigations of the structure and electromagnetic interaction of few-body systems
[DE86-001659] N86-22323

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GEORGIA UNIV., ATHENS.
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[AD-A162546] N86-21773
Systematics of strongly self-dominant higher order differential equations based on the painleve analysis of their singularities
[AD-A162545] N86-22216
Exact dynamically convergent calculations of the frequency-dependent density response function
[AD-A162570] N86-22217
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[AD-A162523] N86-22252
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Performance testing of refractory alloy-clad fuel elements for space reactors
[DE85-018209] N86-22379
HARRY DIAMOND LABS., ADELPHI, MD.
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[AD-A162743] N86-21777
Host materials for transition-metal ions with the ndN electronic configuration
[AD-A161782] N86-21846
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The X-ray properties of normal galaxies. What do we know and what can we learn with the next generation of X-ray telescopes? N86-22466
The LAMAR telescope module for high throughput imaging and spectroscopy N86-22488
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Asymptotic analysis of a mode 1 crack propagating steadily in a deformation theory material
[AD-A161770] N86-21689
Fast and efficient algorithms for linear programming and for the linear least squares problem
[AD-A161391] N86-22161
Motion planning in the presence of moving obstacles
[AD-A161374] N86-22208
Complexity of the generalized mover's problem
[AD-A161378] N86-22209
Shortest paths in Euclidean space with polyhedral obstacles
[AD-A161599] N86-22212
Fluorescence properties of dansyl groups covalently bonded to the surface of oxidatively functionalized low-density polyethylene film
[AD-A162435] N86-22425
HAWAII UNIV., HONOLULU.
Spectral reflectance study of the Hadley-Appenine (Apollo 15) region N86-22521
HC CHEM RESEARCH AND SERVICE, SAN JOSE, CALIF.
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11538-1SB] N86-21590
HERSHEY (MILTON S.) MEDICAL CENTER, HERSHEY, PA.
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[NASA-CR-176620] N86-22095
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Extraction of information from major element chemical analyses of lunar basalts N86-22514
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[AD-A161556] N86-22162
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Stochastic analysis of drought phenomena
[AD-A160947] N86-22060

I

IBM WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, N.Y.
X-ray lithography: Beamline U6 N86-22332
Oxidation of GaSs(110) cleaved surface N86-22345
Polyimide and the polymer-metal interaction N86-22346
Investigations of the etching chemistry of electronic materials N86-22347
High resolution photoemission investigation: The oxidation of W N86-22348
Contact X-ray microscopy of biological materials N86-22370
IDAHO UNIV., MOSCOW.
Improvement of damping in fiber reinforced polymer composites N86-21898
IIT RESEARCH INST., CHICAGO, ILL.
Characterization of emission rates from indoor combustion sources
[PB86-103900] N86-21874
ILLINOIS INST. OF TECH., CHICAGO.
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[AD-A161405] N86-21799
ILLINOIS UNIV., URBANA.
Prediction of detonation transition in porous explosives from rapid compression loadings
[AD-A162767] N86-21711
An experimental study of dielectric rod antennas for millimeter-wave imaging applications
[AD-A161350] N86-21728
The method of conjugate gradients for the numerical solution of large-body electromagnetic scattering problems
[AD-A161550] N86-21730
Diversity combining for frequency-hop spread-spectrum communications with partial-band interference and fading
[AD-A162495] N86-21735
Area-time lower-bound techniques with application to sorting
[AD-A161327] N86-21758
A network flow approach to the wafer scale integration of VLSI arrays
[AD-A161345] N86-21759
Reducing memory references via effective register usage
[AD-A161352] N86-21760
Switch-level timing simulation of MOS VLSI (Metal-Oxide-Semiconductor Very Large-Scale Integrated) circuits
[AD-A161371] N86-21761
Investigation of planar waveguides and components for millimeter-wave integrated circuits
[AD-A161400] N86-21763
The area-time complexity of sorting
[AD-A161562] N86-21767
Plane representations of graphs and visibility between parallel segments
[AD-A161689] N86-21770
Silicon compilation: A solution to the complexity of VLSI (Very Large-Scale Integrated) circuit design
[AD-A162564] N86-21774
Rocket experiments for spectral estimation of electron density fine structure in the auroral and equatorial ionosphere and preliminary results
[NASA-CR-176648] N86-22026
A unified approach to the analysis and synthesis of systolic arrays
[AD-A161326] N86-22132
Special purpose computer architecture for LU factorization of partitioned systems
[AD-A161351] N86-22133
Dictionary machines for cube-class networks
[AD-A161393] N86-22136
A parallel stack processor to reduce procedure-call overhead
[AD-A162494] N86-22140
Simulations among multidimensional iterative arrays, iterative tree automata, and alternating turning machines
[AD-A162661] N86-22142
Clustering algorithms for hierarchical routing in networks
[AD-A161372] N86-22160
Flow optimization in dynamic and continuous networks
[AD-A162493] N86-22172
Multi-input/Multi-Output sensitivity points tuning
[AD-A161641] N86-22193
Correlation in coupled queues and simulation of a stochastic approximation procedure for multiaccess communications
[AD-A161515] N86-22236
M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
Alpha-particle-driven instability of alfven waves in a tandem mirror
[DE86-000741] N86-22382
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INDIANA UNIV., BLOOMINGTON.
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Regolith erosion and regolith mixing at the Apollo 15 site on the moon N86-22511
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Observations of airglow O2 (1 sigma) atmospheric band at 8645A and the rotational temperature at 23 S N86-22030
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[INPE-3717-PRE/853] N86-22057
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[INPE-2716-PRE/852] N86-22058
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J

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[NASA-CR-176652] N86-21519
Chemical bonding technology: Direct investigation of interfacial bonds
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[NASA-CR-176651] N86-21636
The Army Research Institute Unit Performance Research and Development Center
[NASA-CR-176618] N86-21706
A comparison of measured spacecraft modal damping values N86-21903
Comparison of manually produced and automated cross country movement maps using digital image processing techniques
[NASA-CR-176653] N86-21969
Performance evaluation and geologic utility of LANDSAT-4 thematic mapper data
[NASA-CR-176660] N86-21970
The aging correlation (RH + t): Relative humidity (%) + temperature (deg C)
[NASA-CR-176661] N86-21980
High band GaP 3-5 tunneling junction for silicon multijunction solar cells
[NASA-CASE-NPO-16526-1CU] N86-21981
Assessing the capability of EOS sensors in measuring ocean-atmosphere moisture exchange
[NASA-CR-176658] N86-22024
Direct model reference adaptive control of a flexible robotic manipulator
[NASA-CR-176659] N86-22113
The SIMRAND 1 computer program: Simulation of research and development projects
[NASA-CR-176665] N86-22151
The RANDOM computer program: A linear congruential random number generator
[NASA-CR-176664] N86-22152
The SIMRAND methodology: Theory and application for the simulation of research and development projects
[NASA-CR-176663] N86-22153
Surface sensitive photoemission EXAFS: A new structural tool N86-22364
Thin-film chemical sensors based on electron tunneling
[NASA-CR-176662] N86-22418
Archive of observations of periodic comet Crommelin made during its 1983-84 apparition
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Fiber reinforced plastics described N86-21725
TDK affiliate develops new solar power cell N86-21726
USSR report: Physics and mathematics
[JPRS-UPM-86-003] N86-22254
Branches of acoustic oscillations of a gas interacting in resonance with light N86-22255
Modulation of IR lasers by semiconducting plasma N86-22256
Investigation of effect of repeated laser irradiation on active laser glasses N86-22257
Numerical analysis of nonequilibrium flow about airfoil in thin shock layer approximation N86-22258
Numerical solution of problem on decay of high-temperature region of radiating gas with various initial internal energy distributions N86-22259
Shockwave propagation in low-temperature carbon plasma N86-22260
Analysis of efficiency of utilizing alpha-radiation to pre-ionize the working mixture in gas discharge lasers and amplifiers N86-22261
Future possibilities of free-electron laser N86-22262
New findings on creation of powerful tunable subpicosecond solid-state lasers N86-22263
Influence of electromagnetic wave and wiggler fields inhomogeneity on a free-electron laser N86-22264
Effect of pulse dependent discharge on relaxing gas flow N86-22265
IGLAN-3 multibeam CW gas-discharge CO2 laser N86-22266
Investigation of electroionization pulsed carbon dioxide isotope output characteristics N86-22267
Hysteresis effects in Ar+ laser with nonlinear absorber in the cavity N86-22268
Lasing of XeCl, Xe and KrF excimer molecules in two-comonent mistures N86-22269
High-power CO2 electric discharge laser with easily ionized substances added N86-22270
Generation of picosecond pulses in monopulse-pumped dye lasers N86-22271
Spatial, temporal and energy characteristics of copper-vapor laser radiation N86-22272
Comparative analysis of optically and electronically pumped broadband excimer lasers N86-22273
Single-frequency CW lasing in injection laser based on terraced heterostructure with external dispersion cavity N86-22274
Wavelength switching in copper-vapor lasers N86-22275
H2/F2 chemical laser initiated by excimer flashlamp N86-22276
YAG:Er3+ cross-relaxation laser N86-22277
Nonequilibrium effects and structure of X-ray lines in tokamak plasma N86-22278
Study of the kinetics of molecular nitrogen by the method of wide-band coherent antiStokes scattering of light N86-22279
Nonlinear optical spectroscopy of phonon polaritons N86-22280
Diagnosis of populations and relaxation processes of vibrational and rotational states of moleucles in gases by coherent anti-Stokes scattering spectroscopy N86-22281
Intense beams of cold atoms for laser spectroscopy N86-22282
Diffraction efficiency of holographic gratings with symmetrical profiles N86-22283
Determination of optical inhomogeneity of cylindrical bodies by light beam deflection N86-22284
Enhancing efficiency of atom ionization by pulsed periodic lasers N86-22285
Possibiligy of compensating small-scale inhomogeneities by a zernike cell N86-22286
Influence of universal intramolecular interactions on laser radiation from oxazine 17 N86-22287
Radiation focusing by prism raster N86-22288
Investigation of fluorescence kinetics of dyes by parametric frequency conversion N86-22289
Slow combustion of laser plasma and optical charges N86-22290
Spectroscopy of laboratory and space plasma with oscillating electrical fields N86-22291
Equilibrium states of charged electron beams and space charge compensation processes N86-22292
Estimates of paramters of hot electrons during beam heating of plasma in a magnetic field N86-22293
Two-dimensional kinetic model of hydrogen macroparticle evaporation in a tokamak N86-22294
Relativistic effects during Compton interaction of strong electromagnetic radiation and optically thin layer of cold plasma N86-22295
Plasma flows in divertor regions of Vint-20 single-pass torsatron N86-22296
Collision and radiation processes in low-temperature plasma involving highly excited atomic and molecular states N86-22297
Plasma mechanicsm underlying high pressure gas breakdown N86-22298
Nonlinear properties of superconducting point contacts and prospects for use in quantum electronics N86-22299

JOINT RESEARCH CENTRE OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).
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K

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Theory of wing rock
[NASA-CR-176640] N86-21520

KAPTEYN ASTRONOMICAL LAB., RODEN (NETHERLANDS).
A relativistic rotating massive object with saturation of magnetic monopoles N86-22478
Forces exerting on a test particle outside a relativistic rotating massive object with saturation of magnetic monopoles and jets from the object N86-22479

KINGSTON POLYTECHNIC, KINGSTON-UPON-THAMES (ENGLAND).
Synthesis of hydrophobic, crosslinkable resins
[AD-A162702] N86-21692

KIRUNA GEOPHYSICAL INST. (SWEDEN).
An intensified photodiode array applied to one-dimensional auroral imaging N86-22040

L

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Dispersive X-ray spectroscopy with transmission gratings N86-22492

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, N. Y.
Air mass modification in the marginal ice zone
[AD-A161745] N86-22062

LAWRENCE LIVERMORE NATIONAL LAB., CALIF.
New approach for studying the expansion of detonation products
[DE86-000746] N86-21712
Electrical conductivity measurements in shock compressed liquid nitrogen
[DE86-001575] N86-21783
Improvements in the weldability of a superconductor sheath material
[DE86-000748] N86-21867
Real-time monitoring of pre-collapse phenomena using locations of seismic sources
[DE86-001649] N86-22053
Finite element analysis of the Roquefort diagnostic canister
[DE86-000837] N86-22184
Numerical simulation of an accelerator injector
[DE86-001572] N86-22385
Recent progress of the advanced test accelerator
[DE86-001578] N86-22386
Analytical methods of electrode design for a relativistic electron gun
[DE86-001584] N86-22387
Magnetic systems for fusion devices
[DE86-000743] N86-22407

LEICESTER UNIV. (ENGLAND).
X-ray imaging spectroscopy with CCDs N86-22505

LIMBURG STATE UNIV., MAASTRICHT (NETHERLANDS).
Second order approximations N86-22122

LOCKHEED AIRCRAFT CORP., PALO ALTO, CALIF.
Light weight aluminum optics N86-22487

LOCKHEED-CALIFORNIA CO., BURBANK.
A design guide for damping of aerospace structures N86-21923

LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Spectral imaging with a CID camera
[AD-A161608] N86-21824

LOS ALAMOS NATIONAL LAB., N. MEX.
Controlled powder morphology experiments in megabar 304 stainless steel compaction
[DE86-002416] N86-21672
Microcellular foams via phase separation
[DE86-000784] N86-21699
Transient heat pipe investigations for space power systems
[DE86-000813] N86-21806
Conceptual design and analysis of high speed electronic imaging
[AD-A161825] N86-21827
Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios
[DE86-000789] N86-21834
Robotic sample preparation for radiochemical plutonium and americium analyses
[DE96-000801] N86-21868
Applications of tunable VUV radiation N86-22350
LAMPF: Its origins, history, and accomplishments
[DE86-000814] N86-22383
Computation of angle averaged cross sections in a degenerate Compton scattering medium
[DE86-000806] N86-22408

Analytical applications of ICP-FTS
[DE86-000819] N86-22409
Superconductivity in the actinides
[DE86-000786] N86-22433

LTV AEROSPACE CORP., DALLAS, TEX.
Laminated damped fuselage structures N86-21916

LUDWIG-MAXIMILIANS-UNIVERSITAET, MUNICH (WEST GERMANY).
Solar radiative energy N86-21984
Process heat applications N86-21990

LUNAR AND PLANETARY INST., HOUSTON, TEX.
Papers presented to the Workshop on the Geology and Petrology of the Apollo 15 Landing Site
[NASA-CR-176622] N86-22510
Samples at the Apollo 15 landing site: Types and distribution N86-22522

M

MANHATTAN COLL., NEW YORK.
Material damping of carbon/epoxy composites by means of free-free beam resonance tests N86-21897

MARCONI SPACE SYSTEMS LTD., PORTSMOUTH (ENGLAND).
Spacecraft propulsion systems mass modelling study: Assumptions and definitions N86-21578
METEOSAT operational programme: Radiometer imaging electronics radiation analysis
[MTO-51F00-031] N86-21754

MARTIN MARIETTA AEROSPACE, DENVER, COLO.
A derivation of equivalent linear viscous and elastic constant for viscoelastic materials N86-21894
Damping behavior of metal matrix composites N86-21900
Sizing of discrete viscous dampers on a flexible body in the presence of a fixed controller N86-21926
An approach to the sizing of discrete viscous structural dampers using an extension of the finite element approach and modal strain energy N86-21928
Passive and Active Control Of Space Structures (PACOSS) N86-21931

MARYLAND UNIV., COLLEGE PARK.
Computation of three dimensional potential flow around a finite wing with a leading-edge discontinuity at high angle of attack N86-21504
Evolution of N2 excited state vibrational level populations following direct electron excitation N86-22038

MASCHINENFABRIK AUGSBURG-NUERNBERG A.G., MUNICH (WEST GERMANY).
Carbon-fiber reinforced epoxy techniques for the X-ray Multimirror Mission (XMM) Low-Energy (LE) telescopes N86-22490

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Sequential decoding for multiple access channels
[AD-A162630] N86-21738
Wafer-scale integration of systolic arrays
[AD-A161528] N86-21765
A coherent VLSI design environment
[AD-A161743] N86-21771
The synthesis of force closure grasps in the plane
[AD-A162635] N86-21866
Some musings on how to make damping a creative force in design N86-21884
Experimental measurement of material damping for space structures N86-21887
Distributed piezoelectric-polymer active vibration control of a cantilever beam N86-21924
Modeling electrocardiograms using interacting Markov chains
[AD-A162758] N86-22105
BUILD: A tool for maintaining consistency in modular systems
[AD-A162744] N86-22180
MASTIF (MIT analysis and simulation tools for IC fabrication): A workstation approach to fabrication process design
[AD-A162752] N86-22181
The reduction of perturbed markov generators: An algorithm exposing the role of transient states
[AD-A162773] N86-22219
A Markov chain approach to electrocardiogram modeling and analysis
[AD-A162776] N86-22220
Fundamental aspects of filtering theory, statistical signal processing and stochastic variational problems related to estimation of Markov random fields
[AD-A161334] N86-22231
Markov chains with rare transitions and simulated annealing
[AD-A161598] N86-22237
Edge detection
[AD-A162662] N86-22395
The geologic history of quartz-normative and olivine-normative basalts in the vicinity of Hadley Rille (Apollo 15) N86-22517

MASSACHUSETTS INST. OF TECH., LEXINGTON.
Weather radar studies
[AD-A161622] N86-22061
Unclassified publications of Lincoln Laboratory, volume 10
[AD-A161752] N86-22446

MATERIALS RESEARCH LABS., ASCOT VALE (AUSTRALIA).
Burger's equation and shock waves propagating within liquid-gas mixtures
[AD-A161554] N86-21800

MAXIM TECHNOLOGIES, INC., SANTA CLARA, CALIF.
Adaptive antenna nulling performance in a dispersive propagation medium
[AD-A162706] N86-21739

MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
Passively damped joints for advanced space structures N86-21930

MCLEAN RESEARCH CENTER, INC., VA.
Enhancement of project prioritization goal programming formulation and code
[AD-A162412] N86-22169

MCMILLIAN SCIENCE ASSOCIATES, INC., LOS ANGELES, CALIF.
Earthquake light
[AD-A161385] N86-22042

MECHANICAL TECHNOLOGY, INC., LATHAM, N. Y.
Free-piston Stirling engine development
[PB86-102746] N86-21872

MEF ENVIRONMENTAL, INC., AUSTIN, TEX.
EPA (Environmental Protection Agency) oxidant model: Description and evaluation plan
[PB86-103090] N86-22016

MICHIGAN STATE UNIV., EAST LANSING.
Statistical methodologies appropriate in censored survival analyses and competing risk models
[AD-A162703] N86-22245

MICHIGAN UNIV., ANN ARBOR.
Age hardening of binary iron-nickel martensites
[AD-A161407] N86-21683
Harmonic power generation of IMPATT diodes
[AD-A161611] N86-21768
An analysis and simulation of the CRAY X-MP memory system
[AD-A162769] N86-22190

MINNESOTA UNIV., DULUTH.
Suppression of antibody forming cells by muramyl Di-peptides
[AD-A162400] N86-22084
Studies on the mechanism of suppression of the immune response by synthetic, non-toxic adjuvants
[AD-A162444] N86-22085

MINNESOTA UNIV., MINNEAPOLIS.
Characterization of vesicle and microemulsion microstructures
[AD-A161459] N86-21639

MISSION RESEARCH CORP., SANTA BARBARA, CALIF.
Monte Carlo calculations on the direct cable drive due to gamma radiation
[AD-A161734] N86-22375

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE.
A study of singularities in boundary-fitted coordinate systems
[AD-A161756] N86-22214

MITRE CORP., MCLEAN, VA.
Exploring the utility of a staged technology assessment process, volume 1
[PB86-109402] N86-22453
Exploring the utility of a staged technology assessment process, volume 2
[PB86-109410] N86-22454

MULLARD SPACE SCIENCE LAB., DORKING (ENGLAND).
Capabilities of spectroscopy in the context of X-ray astronomy in the 1900's N86-22462
The Penning gas imager in a space application N86-22503
X-ray applications of deep-depletion CCDs N86-22504

N

NAGOYA UNIV. (JAPAN).
Theory for resonant ion acceleration by nonlinear magnetosonic fast and slow waves in finite beta plasmas
[IPPJ-751] N86-22402
Plasma production with rotating ion cyclotron wave excited by Nagoya Type-3 antennas in RFC-XX
[IPPJ-752] N86-22403
The X-ray spectroscopic study of the interstellar medium N86-22470

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.
Comparison of computational results of a few representative three-dimensional transonic potential flow analysis programs
[NASA-TM-77963] N86-21509
Vortex conception of rotor and mutual effect of screw/propellers
[NASA-TM-77979] N86-21510
Propulsion and control propellers with thruster nozzles primarily for aircraft applications
[NASA-TM-77715] N86-21511
Mutual effect of thermochemical surface decomposition and viscous interaction during hypersonic flow past a sharp cone
[NASA-TM-78015] N86-21512
Losses in channels with increased internal turbulence
[NASA-TM-77995] N86-21515
Three-dimensional boundary layer analysis program Blay and its application
[NASA-TM-77962] N86-21516
Procedure for utilizing the lift and thrust forces of ornithopters
[NASA-TM-77682] N86-21534
Vertically operating flight vehicle for drilling and agricultural use
[NASA-TM-77713] N86-21535
High frequency-heated air turbojet
[NASA-TM-77710] N86-21543
Corrosion and corrosion prevention in gas turbines
[NASA-TM-77924] N86-21544
Distributed automatic control of technological processes in conditions of weightlessness
[NASA-TM-77953] N86-21560
Manned spaceflight in the nineties: The European perspective
[NASA-TM-77697] N86-21561
Norwegian aerospace activities: An overview
[NASA-TM-77711] N86-21562
Contemporary achievements in astronautics: Salyut-7, the Vega Project and Spacelab
[NASA-TM-77712] N86-21563
Synthesis of pyromellitic acid esters
[NASA-TM-77977] N86-21583
The effects of surface finish and grain size on the strength of sintered silicon carbide
[NASA-TM-77871] N86-21616
Electrical photosemiconducting and paramagnetic properties of polypyromellitimides
[NASA-TM-77975] N86-21627
Studies on the oxidation of hexamethylbenzene 1: Oxidation of hexamethylbenzene with nitric acid
[NASA-TM-77945] N86-21628
Studies on the oxidation of hexamethylbenzene 2: Preparation of dimethylpyromellitic acid
[NASA-TM-77946] N86-21629
Experimental studies on the reaction kinetics of 1,1-dimethylhydrazine and oxygen
[NASA-TM-77947] N86-21630
Charge transfer complexes of certain aromatic polyimides
[NASA-TM-77974] N86-21631
Theoretical and experimental investigation of the destruction of graphites in a flow of dissociated air N86-21632
Experimental study of the thermal stability of materials in high temperature oxygen-containing media N86-21633
Determination of nitrogen monoxide in high purity nitrogen gas with an atmospheric pressure ionization mass spectrometer
[NASA-TM-77959] N86-21634
Diffusion and solubility of oxygen in silver
[NASA-TM-77938] N86-21655
Effect of additional heat treatment of 2024-T3 on the growth of fatigue crack in air and in vacuum
[NASA-TM-77984] N86-21657
Contribution to the photometric determination of small amounts of boron trioxide in glasses
[NASA-TM-77955] N86-21677
Manufacture of high-density ceramic sinters
[NASA-TM-77925] N86-21678
Silicon carbide sintered products and a method for their manufacturing
[NASA-TM-77932] N86-21679
Capsulation of moldings made from silicon ceramic material
[NASA-TM-77933] N86-21680
Electron microscopic determination of the metastable dissociation region in the system Li sub 2SiO3-SiO sub 2
[NASA-TM-77980] N86-21681
Sensitivity of solid explosives: Minimum energy of a dangerous impact
[NASA-TM-88405] N86-21703

Removal of glass adhered to sintered ceramics in hot isostatic pressing
[NASA-TM-77930] N86-21719
Apparatus for edge etching of semiconductor wafers
[NASA-TM-77998] N86-21720
Ionospheric effects to antenna impedance
[NASA-TM-77956] N86-21727
Surface discharge through an insulator in a vacuum
[NASA-TM-77936] N86-21756
Numerical simulation of vortex breakdown
[NASA-TM-77951] N86-21789
Measurement of heat-transfer coefficients in shock wave-turbulent boundary layer interaction regions with a multi-layered thin film heat transfer gauge
[NASA-TM-77958] N86-21790
Heat and mass transfer in a dissociated laminar boundary layer of air with consideration of the finite rate of chemical reaction
[NASA-TM-78001] N86-21791
Studies of acoustic effects on a flow boundary layer in air
[NASA-TM-77981] N86-21792
Development of perturbations in the boundary layer
[NASA-TM-77986] N86-21793
Semiempirical methods for computing turbulent flows
[NASA-TM-77996] N86-21795
Laminar boundary layer in conditions of natural transition to turbulent flow
[NASA-TM-77985] N86-21796
Infrared diagnosis using liquid crystal detectors
[NASA-TM-77999] N86-21815
Stimulated Raman scattering of light absorbing media excited by ultrashort laser pulses
[NASA-TM-77903] N86-21841
Combustion engine for solid and liquid fuels
[NASA-TM-77714] N86-21855
Thermal deformation of concentrators in an axisymmetric temperature field
[NASA-TM-77935] N86-21977
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 282)
[NASA-SP-7011(282)] N86-22093
The history of aeronautical medicine in Venezuela
[NASA-TM-77709] N86-22094
KNbO3 single crystal growth by the radio frequency heating Czochralski method
[NASA-TM-77944] N86-22416
A study on inclusion formation mechanism in alpha-LIIO sub 3 crystals
[NASA-TM-77943] N86-22417
NASA patent abstracts bibliography: A continuing bibliography. Section 2: Indexes (supplement 28)
[NASA-SP-7039(28)] N86-22444
Method of determining the thermal deformations of astronomical mirrors
[NASA-TM-77941] N86-22457
Meteorite craters
[NASA-TM-78013] N86-22507

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.

Perfluoro (imidoylamidine) diamidines
[NASA-CASE-ARC-11402-3] N86-21562
High performance mixed bisimide resins and composites based thereon
[NASA-CASE-ARC-11538-1SB] N86-21590
Aminophenoxycyclotriphosphazene cured epoxy resins and the composites, laminates and structures thereof
[NASA-CASE-ARC-11548-1] N86-21686
Self-compensating solenoid valve
[NASA-CASE-ARC-11620-1] N86-21859
Airborne tracking Sun photometer apparatus and system
[NASA-CASE-ARC-11622-1] N86-21982

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. DRYDEN (HUGH L.) FLIGHT RESEARCH CENTER, EDWARDS, CALIF.

CID flight/impact N86-21935

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

Concepts and effects of damping in isolators N86-21891
Comparative accuracy of the Albedo, transmission and absorption for selected radiative transfer approximations
[NASA-RP-1160] N86-22022
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
The X-ray spectroscopy of active galactic nuclei N86-22464

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.

Personnel emergency carrier vehicle
[NASA-CASE-KSC-11282-1] N86-22452

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.

Apollo 15 mare units and their petrogenesis N86-22512
Comparison of petrology, grain sizes and surface maturity parameters for Apollo 15 regolith breccias and soils N86-22513

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.

Integration effects of underwing forward- and rearward-mounted separate-flow, flow-through nacelles on a high-wing transport
[NASA-TM-87627] N86-21514
A new method for laminar boundary layer transition visualization in flight: Color changes in liquid crystal coatings
[NASA-TM-87666] N86-21518
STEP and STEPSPL: Computer programs for aerodynamic model structure determination and parameter estimation
[NASA-TM-86410] N86-21549
Effects of wing modification on an aircraft's aerodynamic parameters as determined from flight data
[NASA-TM-87591] N86-21550
Dynamic characteristics of two 300 kW class dual keel space station concepts
[NASA-TM-87680] N86-21569
Thermally induced stresses and deformations in layered composite tubes N86-21598
The dynamic response of composite beams to axial impact N86-21603
A fracture mechanics analysis of impact damage in a thick composite laminate N86-21607
Effects of thickness and ply orientation on buckling of laminated plates
[NASA-TM-87691] N86-21617
Evaluation of a standard test method for total hemispherical emittance of surfaces from 293K to 1673K
[NASA-TM-87681] N86-21660
Ethynyl and substituted ethynyl-terminated polysulfones
[NASA-CASE-LAR-12931-2] N86-21675
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N86-21685
Tool and process for explosive joining of tubes
[NASA-CASE-LAR-13309-1] N86-21858
Full-Scale Transport controlled Impact Demonstration
[NASA-CP-2395] N86-21933
CID overview N86-21934
NASA experiments on the B-720 structure and seats N86-21936
Structural loads preliminary results N86-21940
Controlled impact demonstration on-board (interior) photographic system N86-21946
CID-720 aircraft high-environment flight instrumentation system N86-21947
Impact dynamics instrumentation N86-21948
CID-720 aircraft Langley Research Center preflight hardware tests: Development, flight acceptance and qualification N86-21949
The LATDYN user's manual
[NASA-TM-87635] N86-21953
Equivalent plate analysis of aircraft wing box structures with general planform geometry
[NASA-TM-87697] N86-21954
Drop foot corrective device
[NASA-CASE-LAR-12259-2] N86-22112
On the boundary treatment in spectral methods for hyperbolic systems
[NASA-CR-178055] N86-22204
An optimal repartitioning decision policy
[NASA-CR-178035] N86-22250
Coherent large-scale structures in high Reynolds number supersonic jets
[NASA-CR-3952] N86-22303
Airport-Noise Levels and Annoyance Model (ALAMO) user's guide
[NASA-TM-87695] N86-22304
Airport-Noise Levels and Annoyance Model (ALAMO) system's reference manual
[NASA-TM-87694] N86-22305
Acoustic radiation stress measurement
[NASA-CASE-LAR-13440-1] N86-22307
Scientific and technical information output of the Langley Research Center for Calendar Year 1985
[NASA-TM-87655] N86-22445

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Application of a linearized unsteady aerodynamic analysis to standard cascade configurations
[NASA-CR-3940] N86-21505
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
An analysis for the sound field produced by rigid wide cord dual rotation propellers of high solidarity in compressible flow
[NASA-TM-87178] N86-21517
Analysis of a spacecraft instrument ball bearing assembly lubricated by a perfluoroalkylether
[NASA-TM-87260] N86-21575
Technology for Bayton-cycle powerplants using solar and nuclear energy
[NASA-TP-2558] N86-21577
A bibliography of electrothermal thruster technology, 1984
[NASA-TM-86998] N86-21578
Integrated Composite Analyzer (ICAN): Users and programmers manual
[NASA-TP-2515] N86-21614
Methane oxidation behind reflected shock waves: Ignition delay times measured by pressure and flame band emission
[NASA-TM-87268] N86-21635
Role of molybdenum in the Na sub 2SO sub 4 induced corrosion of superalloys at high temperatures
[NASA-TM-87235] N86-21658
Undercooled and rapidly quenched Ni-Mo alloys
[NASA-TM-87257] N86-21659
Variables controlling fatigue crack growth of short cracks
[NASA-TM-87208] N86-21661
A new chromium carbide-based tribological coating for use to 900 deg C with particular reference to the Stirling engine
[NASA-TM-87274] N86-21682
A comparison of the bromination dynamics of pitch-based and vapor-grown graphite fibers
[NASA-TM-87275] N86-21683
Linearized traveling wave amplifier with hard limiter characteristics
[NASA-CASE-LEW-13981-2] N86-21742
Programmable, automated transistor test system
[NASA-TP-2554] N86-21755
Optically controlled phased array antenna concepts using GaAs monolithic microwave integrated circuits
[NASA-TM-87229] N86-21757
Effect of a rotor wake on the local heat transfer on the forward half of a circular cylinder
[NASA-TM-87234] N86-21794
Piezoviscous effects in nonconformal contacts lubricated hydrodynamically
[NASA-TM-87141] N86-21797
Quasi-modal vibration control by means of active control bearings
[NASA-TM-87232] N86-21856
Lightweight nickel electrode for nickel hydrogen cells and batteries
[NASA-TM-87253] N86-21978
A computer program to calculate the resistivity of a thin film deposited on a conductive substrate from four-point probe measurements
[NASA-TM-87262] N86-22150
Optical elements formed by compressed gases: Analysis and potential applications
[NASA-TP-2555] N86-22390

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Analysis of Jimsphere pairs for use in assessing Space Vehicle ascent capability
[NASA-TP-2573] N86-21506
Investigation of solid plume simulation criteria to produce flight plume effects on multibody configuration in wind tunnel tests
[NASA-TP-2569] N86-21507
Graphical techniques to assist in pointing and control studies of orbiting spacecraft
[NASA-TP-2575] N86-21559
Quasi-containerless glass formation method and apparatus
[NASA-CASE-MFS-28090-1] N86-21684
Containerless high purity pulling process and apparatus for glass fiber
[NASA-CASE-MFS-25905-2] N86-21718
Automated weld torch guidance control system
[NASA-CASE-MFS-25807-2] N86-21850
A torque, tension and stress corrosion evaluation of high strength A286 bolts
[NASA-TM-86539] N86-21950
The MSFC/J70 orbital atmosphere model and the data bases for the MSFC solar activity prediction technique
[NASA-TM-86522] N86-22023
Reconfigurable work station for a video display unit and keyboard
[NASA-CASE-MFS-26009-1SB] N86-22114

Multispectral glancing incidence X-ray telescope
[NASA-CASE-MFS-28013-1] N86-22459

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.
High band GaP 3-5 tunneling junction for silicon multijunction solar cells
[NASA-CASE-NPO-16526-1CU] N86-21981

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A viscous-inviscid interaction method to predict the aerodynamic performance of airfoils at transonic speed
[NAL-TR-873] N86-21508
Electrodermal changes corresponding to the degree of discomfort induced by motion sickness
[NAL-TR-880] N86-22096
Sensitivity of electron thermalization in rare gases to momentum-transfer cross section and impurities
[NAL-TR-866T] N86-22314

NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.
Influence of damage on mechanical performance of woven laminates at low temperature N86-21606
Damping in metal-matrix composites: Measurement and modeling N86-21901

NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD.
NBS (National Bureau of Standards): Materials measurements
[NASA-CR-176646] N86-21648
Handbook for SRM (Standard Reference Materials) users
[PB86-110897] N86-21649
Mechanisms and kinetics of surface alloying by diffusion-induced grain boundary migration
[AD-A161671] N86-21666
Sizing of polystyrene Spheres produced in microgravity
[PB86-102241] N86-21839

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Calibration of a monochromator/spectrometer system for the measurement of photoelectron angular distributions and branching ratios
[DE86-000789] N86-21834

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[PB86-100823] N86-22067
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
[PB85-105723] N86-22081

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Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
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[AD-A161722] N86-21733
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[PB86-100138] N86-22068
Comprehensive Ocean-Atmosphere Data Set (COADS), release 1
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Inventory of non-federally funded marine pollution research, development and monitoring activities: Great Lakes region
[PB86-102308] N86-22012

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Pacific Marine Environmental Laboratory
[PB86-105525] N86-22078

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NOAA (National Oceanic and Atmospheric Administration) Meteorology Division support to the Environmental Progection Agency
[PB86-101664] N86-22054

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Relative intensity-energy calibration of X-ray photoelectron spectrometers: Instructions for the use of reference materials SCAA83
[NPL-DMA(A)-97] N86-21813
The measuring assembly for a primary standard absorbed dose calorimeter
[NPL-RS(EXT)-74] N86-21814
An experimental appraisal of the use of ground-plane microphones for aircraft noise measurement
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Aircraft accident report: Air Canada Flight 797, McDonnell Douglas DC-9-32, C-FTLU Greater Cincinnati International Airport, Covington, Kentucky, June 2, 1983
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Maintenance planning for the 1990's (initial planning)
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[PB86-104684] N86-22071
Monthly and Seasonal Weather Outlook for September 1985, Volume 39, Number 17: August 30, 1985
[PB86-101672] N86-22072

NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
Fatigue properties of multidirectional braided composites
[AD-A162572] N86-21621
Minimization of a six variable boolean function
[AD-A161718] N86-22166

NAVAL AIR TEST CENTER, PATUXENT RIVER, MD.
United States Navy - Canadian forces solid state flight data recorder/crash position locator experiment on the B-720 controlled impact demonstration N86-21945

NAVAL HEALTH RESEARCH CENTER, SAN DIEGO, CALIF.
Mechanisms of bioenergetic homeostasis during exercise: A general model
[AD-A161678] N86-22098
Health and performance of antarctic winter-over personnel: A follow-up study
[AD-A161773] N86-22109

NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY, BAY ST. LOUIS, MISS.
CZCS (Coastal Zone Color Scanner) atlas of water optical properties in the alboran sea
[AD-A162503] N86-22075
Comprehensive final report for the Marine Seismic System Program
[AD-A162539] N86-22077
Geonames processing system functional design specification. Volume 5: Performance specifications
[AD-A162571] N86-22141
Geonames processing system functional design specification. Volume 2: Geographic names data base
[AD-A162504] N86-22173
Geonames processing system functional design specification. Volume 3: Advanced type placement
[AD-A162552] N86-22175

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.
Advanced mail systems technology. Executive summary and appendices A-G
[AD-A161003] N86-22131

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Helicopter performance computer programs for HP-41 hand-held computer
[AD-A162794] N86-21539
An experimental investigation of the effects of swirling air flows on the combustion properties of a solid fuel ramjet motor
[AD-A161382] N86-21580
Effects of waveguide modes on the scattering of a finite tubular cylinder
[AD-A161500] N86-21729
A simulation program with latency exploitation and node tearing
[AD-A161379] N86-21782
Low-noise phase/frequency detector
[AD-A161394] N86-21821
Laser propagation code study
[AD-A161370] N86-21842
Determination of the ductile to brittle transition temperature of platinum-aluminide gas turbine blade coatings
[AD-A161518] N86-21956
Geometrically nonlinear analysis of shell structures using flat DKT shell elements
[AD-A162729] N86-21964
Air parcel motion at the Vandenberg hydrogen flare stacks
[AD-A162520] N86-22063
A decision support system for cost-effectiveness analysis for control and security of computer systems
[AD-A161368] N86-22134
Two new approximate solution techniques for a moving target problem when searcher motion is constrained
[AD-A162491] N86-22171
The queueing model of a packet switch subject to routing in computer networks
[AD-A161638] N86-22188
An organizational development handbook
[AD-A161414] N86-22438

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Using spectral estimation techniques in adaptive processing antenna systems
[AD-A161670] N86-21732
Proceedings of the 38th Annual Gaseous Electronics Conference: Program and abstracts
[AD-A161658] N86-21844
High voltage K sub a -band gyrotron experiment
[AD-A161686] N86-21845
Chaos and nonlinear dynamics of single-particle orbits in a magnetotail-like magnetic field
[AD-A161750] N86-22045

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS, MD.
An experimental evaluation of the effects of selected organic compounds on the formation of insolubles in diesel fuels
[AD-A161323] N86-21586

NAVAL SUBMARINE MEDICAL RESEARCH LAB., GROTON, CONN.
The effects of color-coding in geosit displays. 1: Color as a redundant code
[AD-A161107] N86-22108
Temporary auditory-threshold shifts induced by twenty-five-minute continuous exposures to intense tones in water
[AD-A162404] N86-22311

NAVAL SURFACE WEAPONS CENTER, SILVER SPRING, MD.
Improved extensional modulus measurements for polymers and metal matrix composites N86-21896
Dynamic mechanical properties of graphite/aluminum wires at audiofrequencies N86-21899

NAVAL WEAPONS CENTER, CHINA LAKE, CALIF.
Geothermal potential of Adak Island, Alaska
[AD-A161824] N86-21998
Coso: Example of a complex geothermal reservoir
[AD-A162575] N86-21999
The asymptotic behavior of an exponential-type series
[AD-A162574] N86-22394

NETHERLANDS FOUNDATION FOR RADIO ASTRONOMY, DWINGELO.
The X-ray spectroscopy of supernova remnants N86-22467

NEW MEXICO STATE UNIV., LAS CRUCES.
A multiple-regression model of pilot performance in vertical and translational flight
[AD-A161364] N86-22115

NEW MEXICO UNIV., ALBUQUERQUE.
Rubber removal specification development
[FAA/PM-85/33] N86-21555
Runway rubber removal specification development
[DOT/FAA/PN-85/33] N86-21556
Energy flow in van der Waals molecules N86-22361

NICE UNIV. (FRANCE).
Scintillation Detecting and Ranging (scidar/lidar) description of a gravity wave and associated turbulence N86-22034

NLO, INC., CINCINNATI, OHIO.
Determination of Tri-n-Butyl Phosphate (TBP) in the TBP-mVarsol-HNO3 system using precision densimetry
[DE86-001607] N86-21832

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIV., GREENSBORO.
Vibration isolation of an elevator system N86-21914

NORTH CAROLINA STATE UNIV., RALEIGH.
Performance combustion characteristics and exhaust emission of a direct injection diesel engine using water/oil emulsions as fuel
[AD-A161652] N86-21861
Kinetics and mechanisms of creep in sintered alpha silicon carbide and niobium carbide
[AD-A161455] N86-21955
Investigation of transient aspects of atmospheric dispersion processes in the wake of a building through video image analysis
[PB86-100989] N86-22015
Study on routing and flow control in computer networks
[AD-A161768] N86-22189
NORTH CAROLINA UNIV., CHAPEL HILL.
Neighboring group participation in solvolysis of organosulfur and related compounds
[AD-A161458] N86-21587
On the distance between mixed Poisson and Poisson distributions
[AD-A161337] N86-22206
On prediction of harmonizable stable processes
[AD-A161412] N86-22210
On stochastical integration by series of Wiener integrals
[AD-A161514] N86-22211
Invariance principles under a two-part mixing assumption
[AD-A162800] N86-22223
Existence of random variables with values in the dual of a nuclear space
[AD-A161343] N86-22233
Random integral representations for classes of limit distributions similar to Levy class L(O)
[AD-A161413] N86-22235
Extrema and level crossings of x(2) processes
[AD-A162398] N86-22240
M-estimation for discrete data. Asymptotic distribution theory and implications
[AD-A162779] N86-22246
A measurement of intrinsic SiO2 film stress resulting from low temperature thermal oxidation of Si
[AD-A161620] N86-22420
Silicon oxidation studies. Silicon orientation effects on thermal oxidation
[AD-A161633] N86-22421
A measurement of the effect of intrinsic film stress on the overall rate of thermal oxidation of silicon
[AD-A161634] N86-22422
Models for the oxidation of silicon
[AD-A161751] N86-22424
NORTHEASTERN UNIV., BOSTON, MASS.
Lymphocyte activation - regulatory substances
[AD-A162683] N86-22087
Investigations on statistics of terrain height
[AD-A162517] N86-22243
NORTHWESTERN UNIV., EVANSTON, ILL.
A study of the mechanism of population of high lying rotational states in hydrogen halides
[AD-A161460] N86-21588
Development of an elevated temperature aluminum alloy containing Al3X-type dispersed phases N86-21650
Dynamics and stability of flows with moving contact lines N86-21787
Plastic deformation on the crack line in an elastic perfectly-plastic material N86-21881
Elastodynamic scattering by periodic surface indentations N86-21882
Study of mechanisms of ionic transport in crystalline and glassy solid electrolytes N86-21976
Five year program strategy for Great Lakes National Program Office, 1986-1990
[PB86-107984] N86-22080
Multiple time step partitioned integrators for finite element equations N86-22203
Measurements of proton-proton and proton-antiproton elastic scattering at the European Center for Nuclear Research Intersecting Storage Rings N86-22324
Electroform replication of grazing incidence X-ray optics N86-22491
NOTRE DAME UNIV., IND.
A study of subsurface microstructural changes due to abrasion of aluminum, copper and nickel N86-21653
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670
Resonance valence-band photoemission and h Nu dependent 3p photoemission of MnF2 N86-22368

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Improved amphoteric ion exchanger and its manufacturing method
[DE86-001608] N86-21836
OAK RIDGE NATIONAL LAB., TENN.
Final report on 3 Cr-1.5 Mo steels for gasifier pressure vessel construction
[DE86-002905] N86-21673
Erosion-resistant TiB2 coatings formed by chemical vapor deposition
[DE86-003003] N86-21674
Amphibole ceramics: Conceptual development and preliminary experiments
[DE86-001445] N86-21700
Operating research plan. Volume 2: Inventory of research under the National Acid Precipitation Assessment Program
[DE86-001593] N86-22007
Biomedical and environmental sciences at Oak Ridge National Laboratory
[DE86-001639] N86-22091
Efficient parallel LU factorization with pivoting on a hypercube multiprocessor
[DE86-001461] N86-22143
(252)Cf-source-driven neutron noise analysis method
[DE85-018094] N86-22378
Migration of a radioactive beryllium in the ISX-B tokamak
[DE86-001448] N86-22410
Plasma engineering analysis of a small torsatron reactor
[DE86-001469] N86-22411
OBSERVATOIRE DE BESANCON (FRANCE).
Accreting neutron stars in close binary systems N86-22468
OESTERREICHISCHES FORSCHUNGSZENTRUM SEIBERSDORF G.M.B.H., VIENNA.
The dynamics of heat transfer in a turbulent pipe flow, part 2
[OEFZS-4325-PT-2] N86-21808
Results of large-scale environment monitoring of the Seibersdorf Austrian Research Center
[OEFZS-4324] N86-22006
The Statistical Analysis Program Package (SAPP): A special data analysis program
[OEFZS-4326] N86-22248
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).
Fluid slosh studies for spinning spacecraft
[ONERA-RT-8/3269-SY] N86-21807
OFFICE OF NAVAL RESEARCH, LONDON (ENGLAND).
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[AD-A161089] N86-21721
Quantum electronics in the UK, a National-Survey Conference
[AD-A161623] N86-21769
OHIO STATE UNIV., COLUMBUS.
Buckling of laminated composite plates and shell panels
[AD-A162723] N86-21623
Space-frequency sampling criteria for electromagnetic scattering of a finite object
[AD-A162553] N86-21737
Extensions of the Ritz-Galerkin method for the forced, damped vibrations of structural elements N86-21909
Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants
[AD-A162727] N86-22089
OKLAHOMA STATE UNIV., STILLWATER.
Theoretical investigations of the CVD (Chemical Vapor Deposition) of silicon from silane
[AD-A162548] N86-22426
OLD DOMINION UNIV., NORFOLK, VA.
Thermal sensing of cryogenic wind tunnel model surfaces
[NASA-CR-176641] N86-21557
Radiative interactions in transient energy transfer in gaseous systems
[NASA-CR-176644] N86-21798
Response time for multilayered platinum resistance thermometers
[NASA-CR-176655] N86-21816
OREGON GRADUATE CENTER FOR STUDY AND RESEARCH, BEAVERTON.
Structure and electrical properties of strontium zirconate N86-21751
Semiconductor laser source for natural gas leak detection
[PB86-102811] N86-21849
OREGON STATE UNIV., CORVALLIS.
View based, global design of access structures for relational databases N86-22144
OSLO UNIV. (NORWAY).
On the variability of Sigma Geminorum: An interesting candidate for X-ray studies N86-22476
OSSERVATORIO ASTRONOMICO, PALERMO (ITALY).
Stellar activity: The X-ray picture N86-22469
OSSERVATORIO ASTRONOMICO, ROME (ITALY).
The X-ray spectrum of emission line stars (superluminous and symbiotic) N86-22472
OSSERVATORIO ASTRONOMICO, TURIN (ITALY).
Optical, UV and X-ray observations of X-ray binaries N86-22473
OXFORD UNIV. (ENGLAND).
Behaviour of fibre-reinforced composites under dynamic tension
[OUEL-1602/85] N86-21626
The development of a heat transfer measurement technique for application to rotating turbine blades
[OUEL-1584/85] N86-21810
Experimental studies on cavitation inception in a submerged jet
[OUEL-1586/85] N86-21811
Atom recombination as a source of airglow N86-22036
Tutorials on self-tuning control. Volume 1: Introduction to self-tuning and adaptive control
[OUEL-1592/85-VOL-1] N86-22196
Tutorials on self-tuning control. Volume 2: Automatic tuning of PID regulators
[OUEL-1593/85-VOL-2] N86-22197
Principal direction alignment, a geometric framework for the computer solution to the mu-problem
[OUEL-1595/85] N86-22198
Necessary and sufficient stability conditions for the case of dependent additive perturbations
[OUEL-1596/85] N86-22199
Prediction of stochastic processes using self-tuning principles
[OUEL-1597/85] N86-22200
Robustness of multivariable feedback systems: Analysis and optimal design
[OUEL-1601/85] N86-22201
Recursive estimation for nonlinear Wiener systems by online implementation of Baye's rule
[OUEL-1471/83] N86-22226
Finite element analysis of two cylindrical expansion problems involving near incompressible material behaviour
[OUEL-1580/85] N86-22227
A large strain finite element formulation for one dimensional membrane elements
[OUEL-1603/85] N86-22228
Normality scaling and eigenvalue inclusion regions
[OUEL-1594/85] N86-22249

P

PACIFIC NORTHWEST LAB., RICHLAND, WASH.
Opportunities in pulse combustion
[DE86-001436] N86-22003
PANAMETRICS, INC., WALTHAM, MASS.
Fabricate, calibrate and test a dosimeter for integration into the CRRES (Combined Release and Radiation Effects Satellite)
[AD-A161695] N86-21825
PEI ASSOCIATES, INC., DURHAM, N.C.
User's guide for the multiple airshed (MASH) model
[PB86-100146] N86-22014
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Fatigue response of silicon carbide whisker/aluminum matrix composites N86-21591
Studies of gas-phase clusters: Application to nucleation and aerosol formation
[AD-A161401] N86-21638
A study of precipitation and segregation on an atomic scale of 11at.percentCr-1at.percentMo heat resisting steel by atom-probe and TEM (Transmission Electron Microscope)
[AD-A161590] N86-21664
On the roles of corrosion products in local cell processes
[AD-A162448] N86-21960
Incorporation of active elements into the articulated total body model
[AD-A162518] N86-22101
Color image processing with computer-generated spatial filters in a dispersed white-light optical system N86-22125
Investigations into the origins of the physical structure of thin films
[AD-A162772] N86-22431
Soft X-ray maps of the Large Magellanic Cloud (LMC) N86-22480
PENNSYLVANIA UNIV., PHILADELPHIA.
Deexcitation electron spectroscopy of free and coordinated CO N86-22363
Some aspects of the phenomenological and microscopic theory of nuclear collective motion N86-22374
Search for magnetic monopoles, neutrino oscillations, and superhigh energy particles
[DE86-001548] N86-22536
PHILIPS G.M.B.H., AACHEN (WEST GERMANY).
Solar systems with highly efficient collectors N86-21988

PHILIPS INTERNATIONAL B.V., EINDHOVEN (NETHERLANDS).
A small free-piston Stirling refrigerator N86-21716
PHILIPS LABS., BRIARCLIFF MANOR, NEW YORK.
Design and fabrication of a long-life Stirling cycle cooler for space appliction. Phases 1 and 2: Engineering model
[NASA-CR-175288] N86-21714
Introduction to design and fabrication of a long-life Stirling cycle cooler for space application. Phases 1 and 2: Engineering model N86-21715
Basic principles of the Stirling cycle N86-21717
PHYSICAL SCIENCES, INC., ANDOVER, MASS.
Kinetics and spectroscopy of high altitude infrared emissions
[PSI-G050-SR-207] N86-22032
Fluorescence from electron irradiated gases in refurbished LABCEDE
[AD-A161674] N86-22318
PITTSBURGH UNIV., PA.
Rate coefficients for the oxidation reactions of zirconium ions with oxygen, nitric oxide, and carbon dioxide
[AD-A162694] N86-21645
Effects of estimated noise covariance matrix in optimal signal detection
[AD-A162796] N86-21779
PLESSEY CO. LTD., HAVANT (ENGLAND).
The RTJ1200 video amplifier. Investigation of low noise, low distortion amplifiers for low source impedance
[REPT-52/83/54] N86-21753
POLYTECHNIC INST. OF NEW YORK, BROOKLYN.
Resonant photoemission studies of f-electron systems performed on station U14 N86-22369
PRATT AND WHITNEY AIRCRAFT, WEST PALM BEACH, FLA.
Thermal mechanical fatigue crack growth. An application for fracture mechanics analyses of gas turbine engine disks
[AD-A162634] N86-21962
PRC KENTRON, INC., HAMPTON, VA.
NASA seat experiment and occupant responses N86-21939
Digital filtering and acceleration pulse interpretation N86-21941
PRINCETON UNIV., N. J.
The Time-Temperature-Transformation (TTT) cure diagram of thermosetting systems
[AD-A162628] N86-21691
PUBLIC SERVICE ELECTRIC AND GAS CO., NEWARK, N. J.
Utility cycle testing of a 500-kWh zinc chloride battery at the Battery Energy Storage Test (BEST) Facility
[DE86-001598] N86-22002
PUERTO RICO UNIV., RIO PIEDRAS.
A solvable model for localized adsorption in a Coulomb system
[AD-A162697] N86-21776
PURDUE UNIV., WEST LAFAYETTE, IND.
The predicted effect of aerodynamic detuning on coupled bending-torsion unstalled supersonic flutter
[NASA-TM-87240] N86-21513
Spontaneous ignition delay characteristics of hydrocarbon fuel-air mixtures
[NASA-CR-175064] N86-21545
The science of and advanced technology for cost-effective manufacture of high precision engineering products. Volume 1: Automated detection and error compensation of NC workpiece position
[AD-A161656] N86-21862
Isotonic rules for selecting good truncated exponential populations
[AD-A162790] N86-22247
Inelastic scattering in condensed matter with high intensity Moessbauer radiation
[DE86-002461] N86-22321

Q

QUEENS UNIV., BELFAST (NORTHERN IRELAND).
The nightglow hydroxl (8-3) band emission: A comparison of experiment and theory N86-22031

R

RADIO TECHNICAL COMMISSION FOR AERONAUTICS, WASHINGTON, D. C.
Minimum operational performance standards for airborne Distance Measuring Equipment (DME) operation within the radio frequency range of 960-1215 megahertz
[RTCA/DO-189] N86-21542
RAND CORP., SANTA MONICA, CALIF.
Concepts, problems and opportunities for use of annihilation energy: An annotated briefing on near-term RDT/E to assess feasibility
[AD-A161719] N86-22434
RENSSELAER POLYTECHNIC INST., TROY, N.Y.
Corrosion fatigue of Al-Zn-Mg and Al-Mg-Li alloys
[AD-A162627] N86-21670
RESEARCH INST. FOR PHYSICS, STOCKHOLM (SWEDEN).
Experimental and theoretical information on radiative lifetimes and oscillator strengths N86-22037
RESEARCH INST. OF NATIONAL DEFENCE, STOCKHOLM (SWEDEN).
Airblast loading of wall panels
[FOA-C-20586-D6] N86-21966
RHODE ISLAND UNIV., KINGSTON.
Proceedings of the Gulf Stream Workshop held at West Greenwich, Rhode Island on 23-26 April 1985
[AD-A162506] N86-22076
ROCKWELL INTERNATIONAL CORP., DOWNEY, CALIF.
Structural damping of shuttle orbiter and ascent vehicles N86-21904
ROCKWELL INTERNATIONAL CORP., SEAL BEACH, CALIF.
Damping application to spacecraft N86-21920
ROCKWELL INTERNATIONAL SCIENCE CENTER, THOUSAND OAKS, CALIF.
Investigation into the fatigue crack initiation process in metals
[AD-A162663] N86-21963
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
Structural materials in aeronautics: Prospects and perspectives
[RAE-TR-85077] N86-21532
ROYAL INST. OF TECH., STOCKHOLM (SWEDEN).
Plasma processes in the excitation of Herbig-Haro objects
[TRITA-EPP-84-09] N86-22413
Voyager Saturnian ring measurements and the early history of the solar system
[NASA-CR-176638] N86-22531

S

SAN DIEGO STATE UNIV., CALIF.
Electron production, electron attachment, and charge recombination process in high pressure gas discharges
[AD-A162747] N86-21646
SAN JOSE STATE UNIV., CALIF.
Perfluoro (Imidoylamidine) diamidines
[NASA-CASE-ARC-11402-3] N86-21582
SANDIA NATIONAL LABS., ALBUQUERQUE, N. MEX.
Prototype RECOVER system hardware and software review and future remote monitoring system philosophy. POTAS Task E.59 remote monitoring design review
[DE86-001681] N86-21574
Shock-compression processes in inorganic powders
[DE86-002920] N86-21698
Application of hydrogen analysis to the compatibility testing and long-term aging of explosives
[DE86-001689] N86-21713
Chemical preparation of high-field zinc oxide varistors
[DE86-001611] N86-21784
Automated instrument for qualitative analysis of photographically recorded spectra
[DE86-001621] N86-21833
Optical effects of thin film adhesives in mechanically stacked multijunction solar cells
[DE86-001620] N86-22000
Test data analysis for concentrating photovoltaic arrays
[DE86-001623] N86-22001
SCIENCE APPLICATIONS INTERNATIONAL CORP., LA JOLLA, CALIF.
Japanese Technology Evaluation Program (JTECH): Biotechnology Panel
[PB86-109386] N86-22092
SCIENCE APPLICATIONS INTERNATIONAL CORP., MCLEAN, VA.
Aspects of cognitive complexity theory and research as applied to a managerial decision making simulation
[AD-A161376] N86-22437
SCIENCE RESEARCH COUNCIL, CHILTON (ENGLAND).
Interpretation of the oxygen 7 soft X-ray spectrum from the Puppis-A supernova remnant N86-22481
SHAKER RESEARCH CORP., LATHAM, N.Y.
Turbomachinery incipient failure dynamic detection indicators and analysis
[NASA-CR-178739] N86-21857
SIMULA, INC., PHOENIX, ARIZ.
Preliminary floor, seat, and dummy data N86-21942
SOFTECH, INC., WALTHAM, MASS.
Ada reusability guidelines
[AD-A161259] N86-22157
SOFTWARE AND ENGINEERING ASSOCIATES, INC., CARSON CITY, NEV.
Performance predictions for an SSME configuration with an enlarged throat
[NASA-CR-178740] N86-21579
SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY, RAPID CITY.
Apollo 15 regolith breccias and soils: Comparative petrology and chemistry N86-22524
SOUTHAMPTON UNIV. (ENGLAND).
Average loss factors for use in statistical energy analysis N86-21906
SOUTHERN METHODIST UNIV., DALLAS, TEX.
Constraints on lithospheric structure from satellite potential field data: Africa and Asia. Analysis and interpretation of MAGSAT anomalies over North Africa
[NASA-CR-176611] N86-21968
SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
Fuel property effects on the unaided cold starting of a two-cycle diesel engine
[AD-A162658] N86-21708
SPACE DEVELOPMENT CORP., HAMPTON, VA.
Data reduction, management, and analysis software for CID N86-21938
SPACE RESEARCH ORGANIZATION NETHERLANDS, UTRECHT.
Space research in the Netherlands N86-22456
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Installing a copy of the ARPA/DMA image understanding testbed at the US Army Engineer Topographic Laboratories
[AD-A158394] N86-21818
STANFORD UNIV., CALIF.
Simulation of motions of satellites carrying a deployable flexible linkage N86-21568
Crack initiation and microstructure in tungsten carbide-cobalt composites N86-21651
Point defects and dopant diffusion in silicon N86-21743
Complexity results in VLSI and distributed computing N86-21744
Performance limits of scaled CMOS analog ICs N86-21748
Interface structure and electronic properties of the titanium-silicon system N86-21749
Numerical model and analysis of transistors with polysilicon emitters N86-21750
Research and development of a high average power photoprocessing laser system N86-21840
Influence of growth conditions on the structure and properties of cobalt and cobalt chromium thin films N86-21851
Experiments on the end-point position control of a very flexible one-link manipulator N86-21852
Spatial classification of urban landscapes from landcovcer probeabilities derived through remote sensing N86-21967
Parallel architectures for computer graphics displays N86-22126
Architectural elements for bitmap graphics N86-22127
Time series analysis and multivariate statistical analysis
[AD-A161375] N86-22234
Large-sample theory for standardized time series: An overview
[AD-A161767] N86-22239
Bootstrapping Cox's regression model
[AD-A162443] N86-22241
High resolution acoustic microscopy N86-22301
Extreme ultraviolet emission spectroscopy of atoms and laser applications N86-22313
All-fiber-optic gyroscope with extended linear dynamic range N86-22389
Raman heterodyne interference phenomena N86-22391
Measurements of magnetoacoustic waves in MHD plasmas N86-22400
Far infrared diagnostics of electron concentration in combustion MHD plasmas using interferometry and Faraday rotation N86-22401
Diffusion and defect characterization studies of mercury cadmium telluride
[AD-A162644] N86-22429
STATE UNIV. OF NEW YORK, ALBANY.
Interactions between unstable baroclinic and resonant, topographic waves in a two-layer model of the atmosphere N86-22055
Apollo 15 mare volcanism: Constraints and problems N86-22515

STATE UNIV. OF NEW YORK, BINGHAMTON.
Functional test generation of digital LSI/VLSI systems using machine symbolic execution technique N86-22146

STATE UNIV. OF NEW YORK, BUFFALO.
Critical damping in complex structures and control systems N86-21927

STATE UNIV. OF NEW YORK, STONY BROOK.
Characterization of plasma-sprayed ferrite coatings N86-21854
Numerical methods for differential equations [AD-A162722] N86-22218
Photon stimulted desoprtion of ions from polymer surfaces N86-22367
Scanning soft X-ray microscopy on the U15 beam line N86-22372
Gas phase spectroscopy in the soft X-ray region of the U15 beamline N86-22373
Fusion and fission studies for the system S-32 + U-238 N86-22404

STATE UNIV. OF WESTERN CONNECTICUT, DANBURY.
Long-term X-ray variability in the Hyades cluster N86-22486

STEVENS INST. OF TECH., HOBOKEN, N. J.
Studies of acoustical fields generated by vibrating structures with applications to noise control by design N86-22300

STOCKHOLM UNIV. (SWEDEN).
A Pulse Amplifier/Discriminator (PAD) for single photon counting [AP-24] N86-21838
Inventory of research grade air monitoring stations operated by European research groups [AP-25] N86-22009
Proceedings of the 12th Annual Meeting on Atmospheric Studies by Optical Methods [AP-23] N86-22027

STRESS TECHNOLOGY, INC., ROCHESTER, N.Y.
Damping properties of steam turbine blades N86-21890

STUDSVIK ENERGITEKNIK A.B., NYKOPING (SWEDEN).
District heating by solar energy with heat storage N86-21989

SYRACUSE UNIV., N. Y.
Grain boundary oxidation and an analysis of the effects of pre-oxidation on subsequent fatigue life [NASA-CR-175051] N86-21654
Fatigue crack growth under general-yielding cyclic-loading [NASA-CR-175049] N86-21951
Aeroacoustics of contoured and solid/porous conical plug-nozzle supersonic jet flows [NASA-CR-176645] N86-22308

SYSTEM DEVELOPMENT CORP., SAN DIEGO, CALIF.
Interactive graphics utility for army NEC (Numerical Electromagnetics Code) automation (IGUANA). Installation guide [AD-A161324] N86-22158

T

TECHNION - ISRAEL INST. OF TECH., HAIFA.
Measurement of atmospheric transmission over long paths in the infrared spectral region [AD-A161258] N86-22392

TECHNISCHE UNIV., VIENNA (AUSTRIA).
Critical view of photochemical and photoelectrochemical methods for hydrogen production N86-21992

TEL-AVIV UNIV. (ISRAEL).
Bimane derivatives as fluorescent probes for biological macromolecules [AD-A162725] N86-22088

TENNESSEE UNIV., KNOXVILLE.
Bubble chamber studies of hadron and photon interactions [DE86-002513] N86-22361
Apollo 15 mare basalts: A diverse suite or two distinct groups? N86-22523

TENNESSEE UNIV. SPACE INST., TULLAHOMA.
Nonlinear acoustic wave propagation in atmosphere [NASA-CR-176642] N86-22309

TEXAS A&M UNIV., COLLEGE STATION.
Stationary time series, quantile functions, nonparametric inference and rank transform spectrum [AD-A161749] N86-22238

TEXAS INST. FOR COMPUTATIONAL MECHANICS, AUSTIN.
A finite element analysis of a class of problems in elasto-plasticity with hidden variables [AD-A161642] N86-21957

TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Stochastic non-linear flutter of aeroelastic structures [AD-A162748] N86-21552
On a theory of control for linear systems over rings and nonlinear/time-varying systems [AD-A162680] N86-22194

TEXAS UNIV., AUSTIN.
Analytic theory of the nonlinear M = 1 tearing mode [DE86-001783] N86-22412

THERMEDICS, INC., WOBURN, MASS.
Development of an ultrafast-curing wound dressing [AD-A162471] N86-22099

TILBURG UNIV. (NETHERLANDS).
Comment on: Identification in the linear errors in variable models [FEW-159] N86-22225
On measures of nonnormality of matrices [FEW-167] N86-22253

TOKYO UNIV. (JAPAN).
The X-ray spectra of bursting neutron stars: Effects of Comptonization and bound-free opacity N86-22475
Iron K X-ray emission lines from cosmic X-ray sources observe with TENMA N86-22483

TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
General aviation pilot and aircraft activity survey [AD-A161665] N86-21530

TRISOLAR CORP., BEDFORD, MASS.
Development of a microprocessor controller for stand-alone photovoltaic power systems [NASA-CR-174723] N86-21979

TROCHOID POWER CORP., EDEN PRAIRIE, MINN.
Volumetric trochoidal gas compressor for use as a heat pump [PB86-102720] N86-21871

TROMSOE UNIV. (NORWAY).
Spectroscopic observations of the aurora and nightglow at Svalbard N86-22028
Multiple scattering and radiative transfer in planetary atmospheres N86-22035

TRW, INC., REDONDO BEACH, CALIF.
An experimental study of passive damping and active control of large space structures N86-21925

U

UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
Demonstration test of burner liner strain measuring system [NASA-CR-174743] N86-21817
Characteristics of dry friction damping N86-21889

UNIVERSAL ENERGY SYSTEMS, INC., DAYTON, OHIO.
Complex modulus behavior of a viscoelastic adhesive measured at harmonic strain amplitudes of 10-10 N86-21886

UNIVERSITIES SPACE RESEARCH ASSOCIATION, COLUMBIA, MD.
Soliton turbulence [NASA-CR-3969] N86-22056

UNIVERSITY COLL., CORK (IRELAND).
Re-evaluation of surface properties of oxide-cathode materials [AD-A161131] N86-21687

UNIVERSITY COLL., DUBLIN (IRELAND).
Fault diversity in software reliability [AD-A162757] N86-22182

UNIVERSITY COLL., LONDON (ENGLAND).
Observations of barium ion jets in the magnetosphere using Doppler imaging systems and very sensitive imaging systems using imaging photon detectors N86-22029
Initial simulations of the high latitude thermosphere and ionosphere with a coupled three dimensional model N86-22039
Observations of auroral and airglow spectra using a grating spectrometer with an imaging photon detector N86-22041

UNIVERSITY COLL. OF NORTH WALES, BANGOR.
An evaluation and preparation of ferromagnetic liquid composites for use at millimeter wavelengths [AD-A162753] N86-21624
Development of shearographic imaging system [AD-A161819] N86-21826

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Electrically excited phenomena in gas-phase devices [AD-A161527] N86-21764

UTAH STATE UNIV., LOGAN.
Measurement of horizontal structures and wavelengths (5-500 km) in mesospheric gravity waves, tides and winds. Workshop and design study [AD-A162768] N86-22052

UTAH UNIV., SALT LAKE CITY.
Studies of the electronic structure and excitation properties of vanadium-oxygen compounds with tetrahedral and octahedral V-O coordination. Part 1: Vanadium Pentoxide N86-22365
Photoemission studies of I-II, I-III intermetallic compounds with B32 (Zintl) structure. Part 1: LiAl N86-22366

V

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
A new parabolized Navier-Stokes scheme for hypersonic reentry flows N86-21501
Proceedings of the Second Annual Review of the Center for Composite Materials and Structures N86-21592
Development of high order finite elements to model filament wound composites N86-21593
Design of notched plates under compression N86-21594
Analysis of aluminum/aramid-epoxy hybrid laminates N86-21595
Geometric and material nonlinear bending analysis of laminated composite plates and shells N86-21596
Response and failure analysis of a graphite-epoxy laminate containing terminating internal plies N86-21597
Fracture morphology of 2-D carbon-carbon composition N86-21599
Modeling the curing process of thick-section autoclave cured composites N86-21600
Composite laminate free edge reinforcement concepts N86-21601
Viscoelastic behavior and life-time predictions N86-21602
Nondestructive evaluation of composites by optical time domain reflectometry N86-21604
Boundary layer effects in nearly incompressible cracked bodies N86-21605
Life prediction for composite laminates using critical element concepts N86-21608
NDE of composite materials using ultrasound: Quantitative optical detection N86-21609
Response of thick, notched laminates subjected to tension-compression cyclic loads N86-21610
Fracture of thick graphite/epoxy laminates with part-through surface flaws N86-21611
Characterization of carbon fibers and fiber-matrix adhesion in composites N86-21612
Chemical modification of matrix resin networks with engineering thermoplastics: Morphology and properties of poly(aryl ether sulfone) modified epoxy networks N86-21613
Thermoplastic matrix composite processing model [NASA-CR-176639] N86-21619
Development of LC-13C NMR [NASA-CR-176656] N86-21704
Viscous fluid motion in a spinning and nutating cylinder [AD-A162686] N86-21804
Experimental-theoretical study of velocity feedback damping of structural vibrations N86-21853
Finite-element analysis of adhesively bonded joints [PB86-100708] N86-21869
Thermo-mechanical and thermal behavior of high-temperature structural materials [AD-A161741] N86-21959
A protection model for distributed data base management systems N86-22128
Studies of e(+)e(-) interactions [DE86-001656] N86-22388

VIRGINIA UNIV., CHARLOTTESVILLE.
Limiting performance of nonlinear systems with applications to helicopter vibration control [AD-A161457] N86-21551
Rapidly solidified alloys of iron-rare earth boron for permanent magnets N86-21652
Modifications in microstructure, deformation and fatigue behavior by ion implantation [AD-A161688] N86-21667
Void initiation preceding ductile fracture in polycrystalline titanium [AD-A161821] N86-21668
Study of transport properties and structure of extended-chain polymers [AD-A162765] N86-21694
Study of transport properties and structure of extended-chain polymers: Diffusion and solubility of gases [AD-A162766] N86-21695
A tunneling microscope for operation in air or fluids [AD-A161325] N86-21819

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE (BELGIUM).
Improvements and application of a new type of three component laser Doppler velocimeter [VKI-TM-37] N86-21837

W

WASHINGTON STATE UNIV., PULLMAN.
Research on acoustical scattering, optics of bubbles, diffraction catastrophes, and laser generation of sound by bubbles
[AD-A161333] N86-22310
WASHINGTON UNIV., SEATTLE.
Automated generation of microcontrollers
[AD-A162668] N86-21775
Average collisional vibrational energy transfer quantities. The exponential model
[AD-A161814] N86-22319
WASHINGTON UNIV., ST. LOUIS, MO.
Semiconductor millimeter wavelength electronics
[AD-A162566] N86-22427
Chemical components of the Apollo 15 regolith N86-22518
Petrology and geochemistry of highlands samples from the Apennine Front N86-22519
WESTON (ROY F.), INC., WEST CHESTER, PA.
Installation restoration general environmental technology development. Task 6: Materials handling of explosive contaminated soil and sediment
[AD-A162516] N86-22005
Installation restoration general environmental technology development. Task 8: Bench-scale investigation of low temperature thermal removal of TCE (trichloroethylene) from soil
[AD-A162528] N86-22006
WIEN UNIV. (AUSTRIA).
Boronnitride and siliconnitride systems
[AD-A161563] N86-21640
WISCONSIN UNIV., MADISON.
Implicit B-differentiability in generalized equations
[AD-A160980] N86-22205
The 25th Conference on Statistical Theory and Practice held at the University of Wisconsin, Madison on 29-31 May 1985
[AD-A162645] N86-22244
Excited-state properties of semiconductor electrodes and their application to optical energy conversion
[AD-A162774] N86-22432
WROCLAW UNIV. (POLAND).
The X-ray spectra and the rotation-activity connection of RS CVN binaries N86-22482
WUERZBURG UNIV. (WEST GERMANY).
Transparent superinsulating materials: New aspects in solar technology N86-21987
WUPPERTAL UNIV. (WEST GERMANY).
Middle infrared emission studies in the upper atmosphere by rocket techniques N86-22033
WYOMING UNIV., LARAMIE.
Modified finite strip method with spline functions N86-21878

Y

YALE UNIV., NEW HAVEN, CONN.
Planning by search through simulations
[AD-A162470] N86-21864
Attention within auditory word perception
[AD-A162550] N86-22111
Temporal reasoning and default logics
[AD-A162447] N86-22170
Parallel implementation of preconditioned conjugate gradient methods
[AD-A161988] N86-22186
Adaptive control of multivariable systems
[AD-A162795] N86-22195
Reflectance measurements of aluminum coatings at 200 - 500 nm N86-22351
The effects of autoionization on the alignment of Cd+(4d95s2,2D5/2) N86-22358
Ultramafic parent magmas for mare basalts? N86-22520
YORK UNIV., DOWNSVIEW (ONTARIO).
Binuclear phthalocyanines as model electrocatalysts for the reduction of oxygen
[AD-A161758] N86-21643
YORK UNIV., TORONTO (ONTARIO).
Correlations between electrochemical potentials and optical charge transfer energies in ruthenium bipyridine derivatives
[AD-A161668] N86-22317

Typical Contract Number Index Listing

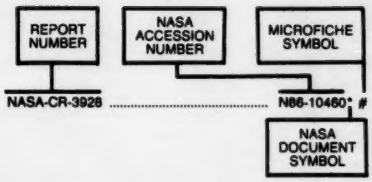
Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 230-1 ..... N86-21772
AF PROJ. 486U N86-21883
AF PROJ. 2567 ..... N86-21827
AF PROJ. 3048 ..... N86-21707
AF PROJ. 5720 ..... N86-22157
AF-AFOSR-ISSA-84-00042 ..... N86-22051
AF-AFOSR-ISSA-85-00084 ..... N86-22051
AF-AFOSR-85-C-0007 ..... N86-22232
AF-AFOSR-0008-85 ..... N86-21552
AF-AFOSR-0014-80 ..... N86-21694
N86-21695
AF-AFOSR-0023-83 ..... N86-22392
AF-AFOSR-0056-83 ..... N86-21622
AF-AFOSR-0081-83 ..... N86-22393
AF-AFOSR-0084-84 ..... N86-22040
AF-AFOSR-0087-81 ..... N86-22089
AF-AFOSR-0095-82 ..... N86-22043
AF-AFOSR-0096-84 ..... N86-22190
AF-AFOSR-0102-83 ..... N86-21734
AF-AFOSR-0121-84 ..... N86-22052
AF-AFOSR-0129-84 ..... N86-21687
AF-AFOSR-0135-82 ..... N86-22231
AF-AFOSR-0145-81 ..... N86-21711
AF-AFOSR-0149-84 ..... N86-22431
AF-AFOSR-0154-83 ..... N86-21895
AF-AFOSR-0156-83 ..... N86-21898
AF-AFOSR-0205-83 ..... N86-22207
AF-AFOSR-0221-81 ..... N86-22207
AF-AFOSR-0242-82 ..... N86-21927
AF-AFOSR-0242-84 ..... N86-22195
AF-AFOSR-0258-82 ..... N86-22105
N86-22219
N86-22220
AF-AFOSR-0282-82 ..... N86-22194
AF-AFOSR-0311-82 ..... N86-22426
AF-AFOSR-0314-82 ..... N86-21646
AF-AFOSR-0326-82 ..... N86-217[illegible]
AF-AFOSR-0383-84 ..... N86-22218
AFOSR-84-0092 ..... N86-21626
AF61(052)-666 ..... N86-21792
ARB-A2-048-32 ..... N86-22017
ARO-MIPR-43-48 ..... N86-21955
ARPA ORDER 7 ..... N86-21818
ARPA ORDER 3829 ..... N86-21731
ARPA ORDER 3862 ..... N86-21818
ARPA ORDER 4152 ..... N86-22077
ARPA ORDER 4563 ..... N86-21775
ARPA ORDER 4700 ..... N86-22042
ARPA ORDER 5019 ..... N86-22429
ARPA ORDER 5378 ..... N86-22447
CM4-1 ..... N86-22158
DA PROJ. RR0-4108 ..... N86-22082
DA PROJ. WR0-2101 ..... N86-21732
DA PROJ. X99-QMXV N86-22375
DA PROJ. 1L1-61102-BH-57 ..... N86-21624
DA PROJ. 1L2-63749-D-462 ..... N86-21777
DA PROJ. 2Q1-62722-A-791 ..... N86-22437
DA PROJ. 2Q2-63743-A-794 ..... N86-21706
DA PROJ. 3E1-62777-A-879 ..... N86-22102
DA PROJ. 3S1-62772-A-874 ..... N86-22100
DA PROJ. 3S1-62775-A-825 ..... N86-22099
DA PROJ. 4A1-62781-AT-45 ..... N86-22174
DAAG29-80-C-0041 ..... N86-22205
DAAG29-81-K-0052 ..... N86-21663
DAAG29-81-K-0145 ..... N86-22044
DAAG29-81-K-0176 ..... N86-22189
DAAG29-82-K-0061 ..... N86-21799
DAAG29-82-K-0063 ..... N86-21768
DAAG29-82-K-0106 ..... N86-22138
DAAG29-82-K-0125 ..... N86-21588
DAAG29-82-K-0137 ..... N86-21764
DAAG29-82-K-0156 ..... N86-22234
DAAG29-82-K-0160 ..... N86-21638
DAAG29-82-K-0164 ..... N86-21551
DAAG29-82-K-0168 ..... N86-22135
N86-22213
DAAG29-82-K-0184 ..... N86-21587
DAAG29-83-K-0015 ..... N86-21861
DAAG29-83-K-0036 ..... N86-21957
DAAG29-83-K-0050 ..... N86-21521
DAAG29-83-K-0051 ..... N86-22238
DAAG29-83-K-0101 ..... N86-22214
DAAG29-84-C-0026 ..... N86-22187
DAAG29-84-K-0005 ..... N86-22237
DAAG29-84-K-0030 ..... N86-22239
DAAG29-84-K-0152 ..... N86-21639
DAAK11-82-C-0017 ..... N86-22005
N86-22006
DAAK11-83-K-0011 ..... N86-21804
DAAK70-80-C-0001 ..... N86-21708
DAAK70-82-C-0001 ..... N86-21708
DAAK70-84-D-0052 ..... N86-22169
DAAK70-85-C-0007 ..... N86-21708
DAJA45-83-C-0026 ..... N86-21624
DAJA45-83-C-0057 ..... N86-22088
DAJA45-84-C-0016 ..... N86-21692
DAJA45-84-C-0038 ..... N86-21640
DAJA45-84-C-0042 ..... N86-21826
DAJA45-84-M-0394 ..... N86-21778
DAMD17-80-C-0094 ..... N86-22100
DAMD17-81-C-1177 ..... N86-22100
DAMD17-83-C-3240 ..... N86-22099
DARPA ORDER 3045 ..... N86-21738
DARPA ORDER 3597 ..... N86-21863
DE-AC02-76CH-00016 ..... N86-21835
N86-22326
N86-22331
N86-22333
N86-22336
N86-22337
N86-22338
N86-22340
N86-22341
N86-22342
N86-22343
N86-22353
N86-22359
N86-22360
N86-22362
N86-22368
N86-22373
DE-AC02-76ET-29368 ..... N86-22002
DE-AC02-80ER-10750 ..... N86-22333
N86-22334
N86-22335
N86-22343
DE-AC02-81ER-40012 ..... N86-22536
DE-AC03-76SF-00098 ..... N86-21701
N86-22322
N86-22384
DE-AC04-76DP-00656 ..... N86-21702
DE-AC04-76DP-00789 ..... N86-21574
N86-21698
N86-21713
N86-21784
N86-21833
N86-22000
N86-22001
DE-AC05-76OR-01156 ..... N86-21832
DE-AC05-84OR-21400 ..... N86-21673
N86-21674
N86-21700
N86-22007
N86-22091
N86-22143
N86-22378
N86-22410
N86-22411
DE-AC05-84OT-21400 ..... N86-21836
DE-AC06-76FF-02170 ..... N86-22379
DE-AC06-76RL-01830 ..... N86-22003
DE-AI-01-77CS-51040 ..... N86-21656
DE-AI-80CS-50194 ..... N86-22451
DE-AI01-79ET-20485 ..... N86-21979
DE-AI01-82ER-13007 ..... N86-22418
DE-AI01-85CE-50112 ..... N86-21682
DE-AI01-85CE-89008 ..... N86-21584
N86-21980
N86-22151
N86-22152
N86-22153
DE-AI08-78ET-44802 ..... N86-22185
DE-AS03-84ER-40136 ..... N86-22380
DE-AS05-76ER-03956 ..... N86-22381
DE-AS05-79ER-10332 ..... N86-22323
DE-AS05-80ER-10713 ..... N86-22388
DE-AS05-83ER-13123 ..... N86-22224
DE-FG02-84ER-13187 ..... N86-22090
DE-FG02-85ER-45199 ..... N86-22321
DE-FG05-80ET-53088 ..... N86-22412
DEN3-310 ..... N86-21979
DEN3-339 ..... N86-22451
DI-14-08-0001-G-880 ..... N86-21973
DI-14-08-0001-G-895 ..... N86-21974
DNA PROJ. X99-QMXV N86-21845
DNA001-81-C-0151 ..... N86-22375
DNA001-83-C-0321 ..... N86-21739
DNA001-84-C-0018 ..... N86-22376
DSB-1112-4/85 ..... N86-22465
DT-FA01-80-Y-10546 ..... N86-22061
DTFA03-84-C-00052 ..... N86-21615
DTRS-57-84-C-00100 ..... N86-21530
EPA-R-005804 ..... N86-22080
EPA-68-02-3512 ..... N86-22014
EPA-68-02-3698 ..... N86-22010
ESTEC-5327/83-NL-BI(SC) N86-21807
FINEP-537/CT N86-22030
F0462-83-C-0079 ..... N86-22042
F04701-83-C-0084 ..... N86-21843
N86-22049
F04701-85-C-0086 ..... N86-21565
N86-21690
F04704-84-C-0072 ..... N86-21637
F19628-80-C-0168 ..... N86-22318
F19628-81-K-0012 ..... N86-22047
F19628-82-C-0030 ..... N86-21824
F19628-82-C-0090 ..... N86-21825
F19628-82-K-0015 ..... N86-22509
F19628-82-K-0035 ..... N86-22535
F19628-83-K-0037 ..... N86-21645
F19628-84-K-0007 ..... N86-22243
F19628-85-C-0002 ..... N86-22446
F29601-84-C-0080 ..... N86-21555
N86-21556
F30602-84-C-0073 ..... N86-22178
F33615-79-C-3206 ..... N86-21918
F33615-80-C-0512 ..... N86-22097
F33615-80-C-5011 ..... N86-21697
F33615-80-C-5160 ..... N86-21962
F33615-81-C-5098 ..... N86-22162
F33615-81-K-3203 ..... N86-21623
F33615-82-C-0509 ..... N86-21736
F33615-82-C-5039 ..... N86-21697
F33615-82-R-3222A N86-21900
F33615-83-C-0506 ..... N86-22101
F33615-83-C-1023 ..... N86-21863
F33615-83-C-2359 ..... N86-21528
N86-21709
F33615-83-C-3208 ..... N86-21662
F33615-84-C-5051 ..... N86-21965
F49620-82-C-0009 ..... N86-22206
N86-22210
N86-22211
N86-22233
N86-22235
N86-22240
F49620-82-K-0007 ..... N86-22230

F49620-82-0018 ..... N86-22434
F49620-83-C-0076 ..... N86-21889
F49620-83-C-0101 ..... N86-21573
F49620-84-C-0085 ..... N86-22192
F49620-85-C-0007 ..... N86-22135
N86-22182
N86-22232
F49620-85-C-0008 ..... N86-21779
F49620-85-C-0144 ..... N86-22206
N86-22223
N86-22246
GRI-5080-342-0389 ..... N86-21871
GRI-5080-342-0439 ..... N86-21870
GRI-5080-342-0440 ..... N86-21870
GRI-5081-251-0575 ..... N86-21874
GRI-5082-241-0772 ..... N86-21873
GRI-5082-242-0721 ..... N86-21872
GRI-5083-231-0961 ..... N86-21870
GRI-5084-260-0998 ..... N86-21849
JPL PROJ. 5101-274 ..... N86-22151
JPL PROJ. 5101-275 ..... N86-22152
JPL PROJ. 5101-277 ..... N86-22153
JPL PROJ. 5101-283 ..... N86-21980
JPL PROJ. 5101-284 ..... N86-21584
MDA903-79-C-0699 ..... N86-22437
MDA903-82-C-0385 ..... N86-21818
MDA903-84-C-0008 ..... N86-21731
MDA903-84-C-0031 ..... N86-22004
MDA903-85-C-0124 ..... N86-22447
MDA903-85-K-0072 ..... N86-21775
MIN-ESC-58340023 ..... N86-22475
MIN-ESC-59050046 ..... N86-22475
MIN-ESC-60540152 ..... N86-22475
MIPR-ARO-42-82 ..... N86-21666
MIPR-ARO-122-85 29 ..... N86-21733
MIPR-ARO-163-83 ..... N86-21666
MIPR-FY7621-83-90003 ..... N86-21827
MIPR-FY6166500914 ..... N86-22063
MIPR-TRASANA-5029 ..... N86-21842
MIPR-105-84 ..... N86-21642
MIPR-155-84 ..... N86-21971
MOD-ER/1/9/4/2057/093-ARE-T N86-21811
MR0-00001 ..... N86-22098
M00-96-PN N86-22311
NAGW-21 ..... N86-21887
NAG1-29 ..... N86-22308
NAG1-134 ..... N86-21520
NAG1-168 ..... N86-21594
NAG1-343 ..... N86-21598
N86-21603
N86-21610
N86-21619
NAG1-389 ..... N86-21601
NAG1-423 ..... N86-21798
NAG1-475 ..... N86-21618
NAG1-527 ..... N86-22309
NAG3-226 ..... N86-21545
NAG3-348 ..... N86-21951
NAG3-424 ..... N86-21909
NAG3-511 ..... N86-21952
NAG3-517 ..... N86-21704
NAG3-583 ..... N86-21656
NAG5-181 ..... N86-22491
NAG5-298 ..... N86-21968
NAG5-309 ..... N86-22022
NAG5-504 ..... N86-22458
NAG8-445 ..... N86-22482
NAG9-118 ..... N86-22095
NASA ORDER H-27954-B N86-21648
NASA ORDER H-78184B N86-22460
NASW-3542 ..... N86-21509
N86-21678
N86-21790
NASW-4004 ..... N86-21516
N86-21543
N86-21544
N86-21560
N86-21657
N86-21681
N86-21703
N86-21727
N86-21789
N86-21841
NASW-4005 ..... N86-21510
N86-21515
N86-21561
N86-21562
N86-21616
N86-21627
N86-21628
N86-21629
N86-21631
N86-21634
N86-21655
N86-21677
N86-21679
N86-21680
N86-21720
N86-21792
N86-21793
N86-21796
N86-21815
N86-21977
N86-22094
N86-22457
N86-22507
NASW-4006 ..... N86-21511
N86-21512
N86-21534
N86-21535
N86-21563
N86-21583
N86-21756
N86-21791
N86-21795
N86-21855
NAS1-16978 ..... N86-22306
NAS1-17070 ..... N86-22204
N86-22250
NAS1-17099 ..... N86-21557
N86-21816
NAS1-17442 ..... N86-22303
NAS1-18107 ..... N86-22204
N86-22250
NAS3-22257 ..... N86-21505
NAS3-23272 ..... N86-21932
NAS3-23690 ..... N86-21817
NAS3-23695 ..... N86-21546
NAS5-25172 ..... N86-21714
NAS5-26613 ..... N86-22488
NAS5-26809 ..... N86-22480
NAS7-100 ..... N86-21519
N86-21903
N86-21969
NAS7-918 ..... N86-21636
N86-21706
N86-21970
N86-21981
N86-22024
N86-22113
N86-22130
N86-22508
NAS8-30751 ..... N86-22466
N86-22482
NAS8-34683 ..... N86-21857
NAS8-35665 ..... N86-21564
NAS8-35815 ..... N86-21554
NAS8-35931 ..... N86-21579
NAS8-36144 ..... N86-22129
NAS8-36153 ..... N86-22056
NAS9-16023 ..... N86-22251
NGR-14-005-181 ..... N86-22026
NSF ATM-81-20371 ..... N86-22534
NSF CHE-82-15061 ..... N86-22367
NSF DCR-85-02202 ..... N86-22205
NSF DCR-85-07573 ..... N86-22161
NSF DMR-81-20804 ..... N86-21955
NSF DMS-84-00602 ..... N86-22246
NSF DMS-84-01021 ..... N86-22223
NSF DMS-85-02346 ..... N86-22182
NSF DMS-85-03016 ..... N86-22223
NSF MCS-80-24649 ..... N86-22241
NSF MCS-81-17633 ..... N86-22180
NSF MCS-82-3438 ..... N86-22239
NSF MCS-82-03232 ..... N86-22161
NSF PRA-82-01177 ..... N86-22453
N86-22454
NSF PRA-85-13755 ..... N86-22092
NSF SMP-83-20252 ..... N86-21605
NSG-7506 ..... N86-22534
NSG5-138 ..... N86-22488
N00014-67-A-0117-0012 ..... N86-21670
N00014-75-C-0690 ..... N86-22319
N00014-76-C-0282 ..... N86-22103
N00014-77-C-0018 ..... N86-22428
N00014-77-C-0505 ..... N86-21620
N00014-78-C-0011 ..... N86-21819
N86-22419
N00014-78-C-0431 ..... N86-21959
N00014-78-C-0633 ..... N86-22432
N00014-79-C-0424 ..... N86-21760
N00014-79-C-0522 ..... N86-22245
N00014-79-C-0840 ..... N86-22427
N00014-80-C-0505 ..... N86-21866
N86-22180
N86-22395
N00014-80-C-0622 ..... N86-21765
N86-21771
N00014-80-C-0647 ..... N86-22161
N86-22208
N86-22209
N86-22212
N00014-81-C-0776 ..... N86-21776
N00014-81-K-0439 ..... N86-22115
N00014-82-C-0160 ..... N86-22111
N00014-82-C-0283 ..... N86-22087
N00014-82-C-2094 ..... N86-22332
N00014-82-C-2488 ..... N86-21566
N00014-82-K-0037 ..... N86-21737
N00014-82-K-0184 ..... N86-22186
N00014-82-K-0185 ..... N86-21869
N00014-82-K-0309 ..... N86-21668
N00014-82-K-0334 ..... N86-21866
N00014-82-K-0359 ..... N86-22172
N00014-82-K-0497 ..... N86-21693
N00014-82-K-0578 ..... N86-22423
N00014-82-K-0635 ..... N86-22084
N86-22085
N00014-82-6(C)-2488 ..... N86-21567
N00014-83-C-0464 ..... N86-22074
N00014-83-K-0142 ..... N86-22425
N00014-83-K-0263 ..... N86-21667
N00014-83-K-0268 ..... N86-21829
N86-22320
N86-22406
N00014-83-K-0343 ..... N86-21641
N00014-83-K-0385 ..... N86-21862
N00014-83-K-0472 ..... N86-22241
N00014-83-K-0571 ..... N86-22420
N86-22421
N86-22422
N86-22424
N00014-84-C-0145 ..... N86-21688
N00014-84-C-0149 ..... N86-21728
N86-21730
N86-21735
N86-21758
N86-21759
N86-21761
N86-21762
N86-21763
N86-21767
N86-21770
N86-21774
N86-22132
N86-22133
N86-22136
N86-22140
N86-22160
N86-22193
N86-22236
N00014-84-C-0167 ..... N86-22247
N00014-84-C-0720 ..... N86-22177
N00014-84-C-2174 ..... N86-22046
N00014-84-G-0201 ..... N86-21643
N86-22317
N00014-84-K-0021 ..... N86-21691
N00014-84-K-0201 ..... N86-21684
N86-21960
N00014-84-K-0264 ..... N86-21665
N00014-84-K-0345 ..... N86-22191
N00014-84-K-0350 ..... N86-22238
N00014-84-K-0357 ..... N86-21738
N00014-84-K-0365 ..... N86-21773
N86-22216
N00014-84-K-0423 ..... N86-22429
N00014-84-K-0569 ..... N86-22377
N00014-84-K-0626 ..... N86-22086
N00014-84-K-0735 ..... N86-22062
N00014-84-K-2015 ..... N86-22430
N00014-85-C-0141 ..... N86-22310
N00014-85-G-0055 ..... N86-22082
N00014-85-G-0073 ..... N86-22244
N00014-85-G-0161 ..... N86-22242
N00014-85-G-0322 ..... N86-22076
N00014-85-K-0213 ..... N86-22181
N00014-85-K-0222 ..... N86-21696
N00014-85-K-0301 ..... N86-21864
N86-22170
N00014-85-K-0365 ..... N86-22217
N86-22252
N00039-80-C-0556 ..... N86-22140
N60921-85-C-0056 ..... N86-21875
N61533-82-M-2379 ..... N86-21586
N62269-83-C-0267 ..... N86-21963
N62269-83-D-0115 ..... N86-22167
N66001-83-D-0094 ..... N86-22158
PRF ACS-1477GS N86-22343
RR0-1109 ..... N86-21845
RR0-2102 ..... N86-22427
RR0-4108 ..... N86-22084
N86-22085
STU-AU-2168 ..... N86-22312
STU-84-4563 ..... N86-21809
STW-CWI-22-0348 ..... N86-22124
SWED-NSRC-O-TA-2628-118 ..... N86-22027
TA-83-SAC-02254 ..... N86-22092
W-7405-ENG-36 ..... N86-21672

	N86-21699
	N86-21806
	N86-21834
	N86-21868
	N86-22383
	N86-22408
	N86-22409
	N86-22433
W-7405-ENG-48	N86-21712
	N86-21783
	N86-21867
	N86-22053
	N86-22184
	N86-22382
	N86-22385
	N86-22386
	N86-22387
	N86-22407
WRO-2303	N86-21621
ZR0-0001	N86-22394
Z08-29	N86-21999
Z08-38	N86-21586
158-02-02-01	N86-22508
482-53-53-34	N86-21953
483-32-33-01	N86-21569
505-31-04	N86-21794
505-31-33	N86-22303
505-31-42	N86-21545
505-31-83-01	N86-22204
	N86-22250
505-33-7A	N86-21614
505-33-7C	N86-21661
505-33-53-05	N86-21933
505-33-62	N86-21797
505-34-03-06	N86-21550
505-35-13-01	N86-22304
	N86-22305
505-35-13-53	N86-22306
505-40-14	N86-22390
505-43-90-07	N86-21514
505-45-58	N86-21505
505-61-41-02	N86-21518
505-62-01	N86-22150
505-62-21	N86-21635
505-63-01	N86-21575
505-63-11	N86-21658
	N86-21856
505-63-11-01	N86-21954
505-66-01-04	N86-21549
506-41-3A	N86-21978
506-41-48	N86-21683
506-43-11	N86-21618
506-43-81-01	N86-21660
506-46-11-01	N86-22113
506-54-15-39	N86-21636
506-55-24	N86-21578
506-55-72	N86-21755
506-58-22	N86-21757
533-04-11	N86-21952
533-04-12	N86-21951
534-06-23-08	N86-21617
535-03-01	N86-21513
	N86-21517
674-25-05	N86-21659
776-52-61	N86-21584
	N86-21980
	N86-22151
	N86-22152
	N86-22153
778-19-75	N86-22418
778-35-13	N86-21682

Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

AAMRL-TR-85-058 ..... N86-22097 #
AAMRL-TR-85-061 ..... N86-22101 #

ACT-52 ..... N86-21767 #
ACT-53 ..... N86-22136 #
ACT-56 ..... N86-22132 #
ACT-57 ..... N86-21770 #
ACT-59 ..... N86-21758 #
ACT-61 ..... N86-21759 #
ACT-66 ..... N86-22142 #

AD-A152547 ..... N86-21883 #
AD-A158394 ..... N86-21818 #
AD-A160221 ..... N86-22191 #
AD-A160947 ..... N86-22060 #
AD-A160950 ..... N86-21527 #
AD-A160980 ..... N86-22205 #
AD-A161002 ..... N86-22130* #
AD-A161003 ..... N86-22131 #
AD-A161039 ..... N86-21585 #
AD-A161053 ..... N86-22107 #
AD-A161069 ..... N86-21721 #
AD-A161094 ..... N86-21528 #
AD-A161107 ..... N86-22108 #
AD-A161131 ..... N86-21687 #
AD-A161258 ..... N86-22392 #
AD-A161259 ..... N86-22157 #
AD-A161269 ..... N86-21637 #
AD-A161311 ..... N86-22436 #
AD-A161322 ..... N86-22230 #
AD-A161323 ..... N86-21586 #
AD-A161324 ..... N86-22158 #
AD-A161325 ..... N86-21819 #
AD-A161326 ..... N86-22132 #
AD-A161327 ..... N86-21758 #
AD-A161331 ..... N86-22082 #
AD-A161333 ..... N86-22310 #
AD-A161334 ..... N86-22231 #
AD-A161337 ..... N86-22206 #
AD-A161338 ..... N86-21573 #
AD-A161339 ..... N86-21500 #
AD-A161340 ..... N86-21820 #
AD-A161341 ..... N86-22232 #
AD-A161342 ..... N86-22159 #
AD-A161343 ..... N86-22233 #
AD-A161345 ..... N86-21759 #
AD-A161349 ..... N86-22192 #
AD-A161350 ..... N86-21728 #
AD-A161351 ..... N86-22133 #
AD-A161352 ..... N86-21760 #
AD-A161364 ..... N86-22115 #
AD-A161366 ..... N86-21662 #
AD-A161368 ..... N86-22207 #
AD-A161370 ..... N86-21842 #
AD-A161371 ..... N86-21761 #
AD-A161372 ..... N86-22160 #
AD-A161374 ..... N86-22208 #
AD-A161375 ..... N86-22234 #
AD-A161376 ..... N86-22437 #
AD-A161378 ..... N86-22209 #
AD-A161379 ..... N86-21762 #
AD-A161382 ..... N86-21580 #
AD-A161385 ..... N86-22042 #
AD-A161388 ..... N86-22134 #
AD-A161390 ..... N86-21843 #
AD-A161391 ..... N86-22161 #
AD-A161392 ..... N86-22135 #
AD-A161393 ..... N86-22136 #
AD-A161394 ..... N86-21821 #
AD-A161397 ..... N86-22449 #
AD-A161399 ..... N86-22187 #
AD-A161400 ..... N86-21763 #
AD-A161401 ..... N86-21638 #
AD-A161403 ..... N86-21581 #
AD-A161405 ..... N86-21799 #
AD-A161407 ..... N86-21663 #
AD-A161412 ..... N86-22210 #
AD-A161413 ..... N86-22235 #
AD-A161414 ..... N86-22438 #
AD-A161453 ..... N86-21971 #
AD-A161455 ..... N86-21955 #
AD-A161457 ..... N86-21551 #
AD-A161458 ..... N86-21587 #
AD-A161459 ..... N86-21639 #
AD-A161460 ..... N86-21586 #
AD-A161499 ..... N86-21688 #
AD-A161500 ..... N86-21729 #
AD-A161513 ..... N86-21521 #
AD-A161514 ..... N86-22211 #
AD-A161515 ..... N86-22236 #
AD-A161518 ..... N86-21956 #
AD-A161521 ..... N86-21822 #
AD-A161527 ..... N86-21764 #
AD-A161528 ..... N86-21765 #
AD-A161537 ..... N86-22419 #
AD-A161550 ..... N86-21730 #
AD-A161554 ..... N86-21800 #
AD-A161555 ..... N86-21823 #
AD-A161556 ..... N86-22162 #
AD-A161557 ..... N86-21705 #
AD-A161558 ..... N86-22097 #
AD-A161559 ..... N86-21766 #
AD-A161562 ..... N86-21767 #
AD-A161563 ..... N86-21640 #
AD-A161590 ..... N86-21664 #
AD-A161598 ..... N86-22237 #
AD-A161599 ..... N86-22212 #
AD-A161608 ..... N86-21824 #
AD-A161609 ..... N86-22073 #
AD-A161611 ..... N86-21768 #
AD-A161614 ..... N86-21731 #
AD-A161616 ..... N86-21706* #
AD-A161619 ..... N86-22043 #
AD-A161620 ..... N86-22420 #
AD-A161621 ..... N86-22509 #
AD-A161622 ..... N86-22061 #
AD-A161623 ..... N86-21769 #
AD-A161633 ..... N86-22421 #
AD-A161634 ..... N86-22422 #
AD-A161637 ..... N86-21529 #
AD-A161638 ..... N86-22188 #
AD-A161640 ..... N86-21641 #
AD-A161641 ..... N86-22193 #
AD-A161642 ..... N86-21957 #
AD-A161646 ..... N86-21860 #
AD-A161648 ..... N86-22163 #
AD-A161650 ..... N86-22393 #
AD-A161651 ..... N86-22535 #
AD-A161652 ..... N86-21861 #
AD-A161653 ..... N86-21642 #
AD-A161656 ..... N86-21862 #
AD-A161658 ..... N86-21844 #
AD-A161661 ..... N86-22213 #
AD-A161664 ..... N86-21537 #
AD-A161665 ..... N86-21530 #
AD-A161666 ..... N86-21665 #
AD-A161667 ..... N86-21707 #
AD-A161668 ..... N86-22317 #
AD-A161670 ..... N86-21732 #
AD-A161671 ..... N86-21666 #
AD-A161674 ..... N86-22318 #
AD-A161678 ..... N86-22098 #
AD-A161682 ..... N86-22164 #
AD-A161683 ..... N86-21547 #
AD-A161686 ..... N86-21845 #
AD-A161688 ..... N86-21667 #
AD-A161689 ..... N86-21770 #
AD-A161690 ..... N86-22137 #
AD-A161695 ..... N86-21825 #
AD-A161715 ..... N86-22165 #
AD-A161718 ..... N86-22166 #
AD-A161719 ..... N86-22434 #
AD-A161720 ..... N86-22044 #
AD-A161722 ..... N86-21733 #
AD-A161729 ..... N86-22439 #
AD-A161733 ..... N86-21958 #
AD-A161734 ..... N86-22375 #
AD-A161740 ..... N86-22423 #
AD-A161741 ..... N86-21959 #
AD-A161742 ..... N86-22074 #
AD-A161743 ..... N86-21771 #
AD-A161745 ..... N86-22062 #
AD-A161746 ..... N86-22138 #
AD-A161749 ..... N86-22238 #
AD-A161750 ..... N86-22045 #
AD-A161751 ..... N86-22424 #
AD-A161752 ..... N86-22446 #
AD-A161753 ..... N86-22046 #
AD-A161756 ..... N86-22214 #
AD-A161757 ..... N86-22440 #
AD-A161758 ..... N86-21643 #
AD-A161767 ..... N86-22239 #
AD-A161768 ..... N86-22189 #
AD-A161770 ..... N86-21669 #
AD-A161772 ..... N86-21620 #
AD-A161773 ..... N86-22109 #
AD-A161776 ..... N86-22167 #
AD-A161782 ..... N86-21846 #
AD-A161783 ..... N86-22441 #
AD-A161784 ..... N86-22442 #
AD-A161807 ..... N86-22004 #
AD-A161811 ..... N86-22083 #
AD-A161812 ..... N86-22405 #
AD-A161814 ..... N86-22319 #
AD-A161817 ..... N86-22168 #
AD-A161819 ..... N86-21826 #
AD-A161821 ..... N86-21668 #
AD-A161822 ..... N86-22215 #
AD-A161824 ..... N86-21998 #
AD-A161825 ..... N86-21827 #
AD-A161988 ..... N86-22186 #
AD-A162398 ..... N86-22240 #
AD-A162400 ..... N86-22084 #
AD-A162401 ..... N86-22320 #
AD-A162404 ..... N86-22311 #
AD-A162406 ..... N86-21828 #
AD-A162407 ..... N86-21801 #
AD-A162408 ..... N86-21369 #
AD-A162412 ..... N86-22169 #
AD-A162415 ..... N86-22406 #
AD-A162416 ..... N86-21772 #
AD-A162434 ..... N86-21644 #
AD-A162435 ..... N86-22425 #
AD-A162436 ..... N86-21802 #
AD-A162440 ..... N86-22139 #
AD-A162441 ..... N86-21863 #
AD-A162442 ..... N86-21734 #
AD-A162443 ..... N86-22241 #
AD-A162444 ..... N86-22085 #
AD-A162447 ..... N86-22170 #
AD-A162448 ..... N86-21960 #
AD-A162467 ..... N86-22047 #
AD-A162470 ..... N86-21864 #
AD-A162471 ..... N86-22099 #
AD-A162472 ..... N86-21829 #
AD-A162473 ..... N86-22116 #
AD-A162478 ..... N86-22242 #
AD-A162483 ..... N86-22100 #
AD-A162486 ..... N86-22110 #
AD-A162491 ..... N86-22171 #
AD-A162493 ..... N86-22172 #
AD-A162494 ..... N86-22140 #
AD-A162495 ..... N86-21735 #
AD-A162499 ..... N86-22048 #
AD-A162503 ..... N86-22075 #
AD-A162504 ..... N86-22173 #
AD-A162506 ..... N86-22076 #

AD-A162507 ..... N86-21961 #
AD-A162508 ..... N86-21690 #
AD-A162509 ..... N86-21736 #
AD-A162516 ..... N86-22005 #
AD-A162517 ..... N86-22243 #
AD-A162518 ..... N86-22101 #
AD-A162519 ..... N86-21589 #
AD-A162520 ..... N86-22063 #
AD-A162522 ..... N86-22174 #
AD-A162523 ..... N86-22252 #
AD-A162526 ..... N86-22006 #
AD-A162531 ..... N86-22049 #
AD-A162539 ..... N86-22077 #
AD-A162542 ..... N86-21565 #
AD-A162545 ..... N86-22216 #
AD-A162546 ..... N86-21773 #
AD-A162548 ..... N86-22426 #
AD-A162550 ..... N86-22111 #
AD-A162552 ..... N86-22175 #
AD-A162553 ..... N86-21737 #
AD-A162555 ..... N86-22176 #
AD-A162561 ..... N86-21865 #
AD-A162564 ..... N86-21774 #
AD-A162566 ..... N86-22427 #
AD-A162567 ..... N86-21875 #
AD-A162570 ..... N86-22217 #
AD-A162571 ..... N86-22141 #
AD-A162572 ..... N86-21621 #
AD-A162573 ..... N86-22428 #
AD-A162574 ..... N86-22394 #
AD-A162575 ..... N86-21999 #
AD-A162627 ..... N86-21670 #
AD-A162628 ..... N86-21691 #
AD-A162630 ..... N86-21738 #
AD-A162631 ..... N86-21803 #
AD-A162634 ..... N86-21982 #
AD-A162635 ..... N86-21866 #
AD-A162636 ..... N86-22177 #
AD-A162644 ..... N86-22429 #
AD-A162645 ..... N86-22244 #
AD-A162646 ..... N86-21538 #
AD-A162655 ..... N86-22178 #
AD-A162658 ..... N86-21708 #
AD-A162660 ..... N86-21709 #
AD-A162661 ..... N86-22142 #
AD-A162662 ..... N86-22395 #
AD-A162663 ..... N86-21963 #
AD-A162664 ..... N86-22086 #
AD-A162668 ..... N86-21775 #
AD-A162680 ..... N86-22194 #
AD-A162683 ..... N86-22087 #
AD-A162686 ..... N86-21804 #
AD-A162689 ..... N86-21622 #
AD-A162691 ..... N86-22050 #
AD-A162694 ..... N86-21645 #
AD-A162697 ..... N86-21776 #
AD-A162698 ..... N86-22179 #
AD-A162702 ..... N86-21692 #
AD-A162703 ..... N86-22245 #
AD-A162707 ..... N86-22376 #
AD-A162708 ..... N86-21739 #
AD-A162722 ..... N86-22216 #
AD-A162723 ..... N86-21623 #
AD-A162725 ..... N86-22088 #
AD-A162726 ..... N86-21522 #
AD-A162727 ..... N86-22089 #
AD-A162728 ..... N86-22102 #
AD-A162729 ..... N86-21964 #
AD-A162730 ..... N86-22103 #
AD-A162739 ..... N86-21965 #
AD-A162740 ..... N86-21693 #
AD-A162743 ..... N86-21777 #
AD-A162744 ..... N86-22180 #
AD-A162746 ..... N86-21710 #
AD-A162747 ..... N86-21646 #
AD-A162748 ..... N86-21552 #
AD-A162750 ..... N86-22430 #
AD-A162751 ..... N86-21671 #
AD-A162752 ..... N86-22181 #
AD-A162753 ..... N86-21624 #
AD-A162754 ..... N86-22051 #
AD-A162755 ..... N86-22104 #
AD-A162757 ..... N86-22182 #
AD-A162758 ..... N86-22105 #
AD-A162765 ..... N86-21694 #
AD-A162766 ..... N86-21695 #
AD-A162767 ..... N86-21711 #
AD-A162768 ..... N86-22052 #
AD-A162769 ..... N86-22190 #
AD-A162771 ..... N86-22447 #
AD-A162772 ..... N86-22431 #
AD-A162773 ..... N86-22219 #
AD-A162774 ..... N86-22432 #
AD-A162775 ..... N86-21696 #
AD-A162776 ..... N86-22220 #
AD-A162777 ..... N86-21566 #
AD-A162778 ..... N86-21567 #
AD-A162779 ..... N86-22246 #
AD-A162785 ..... N86-21778 #
AD-A162790 ..... N86-22247 #
AD-A162791 ..... N86-22377 #
AD-A162792 ..... N86-22443 #
AD-A162793 ..... N86-21697 #
AD-A162794 ..... N86-21539 #
AD-A162795 ..... N86-22195 #
AD-A162796 ..... N86-21779 #
AD-A162798 ..... N86-22221 #
AD-A162799 ..... N86-22222 #
AD-A162800 ..... N86-22223 #
AD-A995286 ..... N86-21536 #

AD-D011974 ..... N86-21740 #
AD-D011975 ..... N86-21722 #
AD-D011976 ..... N86-21647 #
AD-D011977 ..... N86-21780 #
AD-D011978 ..... N86-21625 #
AD-D011979 ..... N86-22396 #
AD-D011980 ..... N86-21540 #
AD-D011981 ..... N86-22506 #
AD-D011982 ..... N86-21781 #
AD-D011983 ..... N86-21830 #
AD-D011984 ..... N86-22183 #
AD-D011985 ..... N86-21805 #
AD-D011986 ..... N86-21847 #
AD-D011989 ..... N86-21848 #
AD-D011990 ..... N86-22397 #
AD-D011991 ..... N86-21831 #
AD-D011992 ..... N86-21741 #
AD-D011996 ..... N86-22398 #
AD-D011997 ..... N86-21782 #
AD-D011998 ..... N86-21548 #
AD-D012025 ..... N86-21676

AD-E301835 ..... N86-22439 #
AD-E301842 ..... N86-22375 #
AD-E301861 ..... N86-22376 #
AD-E301864 ..... N86-21739 #
AD-E301866 ..... N86-21692 #
AD-E301866 ..... N86-22245 #
AD-E440302 ..... N86-21958 #
AD-E440303 ..... N86-21860 #
AD-E500730 ..... N86-22004 #
AD-E500731 ..... N86-22167 #
AD-E801223 ..... N86-21827 #
AD-E900521 ..... N86-21999 #
AD-E900526 ..... N86-21668 #
AD-E900526 ..... N86-21998 #
AD-E900526 ..... N86-22215 #
AD-E900526 ..... N86-21621 #
AD-E900526 ..... N86-22141 #
AD-E900526 ..... N86-22217 #
AD-E900526 ..... N86-22394 #
AD-E900526 ..... N86-22428 #

AEDC-TR-85-42 ..... N86-21581 #

AERONOMICA-ACTA-A-297-1985 ..... N86-22019
AERONOMICA-ACTA-A-299-1985 ..... N86-22020
AERONOMICA-ACTA-A-300-1985 ..... N86-22021
AERONOMICA-ACTA-A-301-1985 ..... N86-22533

AERONOMY-119 ..... N86-22026* #

AFAMRL-TR-85-003 ..... N86-21736 #

AFATL-TR-85-65 ..... N86-21827 #
AFATL-TR-85-98 ..... N86-21705 #

AFGL-AFSG-448 ..... N86-22048 #

AFGL-PSRP-668 ..... N86-22050 #

AFGL-TR-84-0218 ..... N86-22318 #
AFGL-TR-85-0062 ..... N86-22047 #
AFGL-TR-85-0075 ..... N86-21824 #
AFGL-TR-85-0077 ..... N86-22050 #
AFGL-TR-85-0124 ..... N86-22509 #
AFGL-TR-85-0129 ..... N86-22048 #
AFGL-TR-85-0150 ..... N86-21825 #
AFGL-TR-85-0152 ..... N86-22535 #
AFGL-TR-85-0247 ..... N86-22043 #
AFGL-TR-85-0308 ..... N86-21645 #

AFIT/GLM/LSH/85S-40 ..... N86-21820 #

AFIT/GLM/LSM/85S-11 ..... N86-22107 #
AFIT/GLM/LSM/85S-57 ..... N86-22449 #
AFIT/GLM/LSM/85S-59 ..... N86-21500 #
AFIT/GLM/LSM/85S-62 ..... N86-22165 #
AFIT/GLM/LSM/85S-69 ..... N86-22439 #
AFIT/GLM/LSM/85S-79 ..... N86-22441 #
AFIT/GSM/LS/85S-16 ..... N86-22164 #
AFIT/GSM/LS/85S-20 ..... N86-22442 #

AFIT/GSM/LSQ/85S-18 ..... N86-22163 #

AFIT/GSM/LSY/85S-5 ..... N86-22137 #
AFIT/GSM/LSY/85S-8 ..... N86-21547 #

AFIT/LS/GLM/85S-58 ..... N86-22436 #

AFOSR-85-0890TR ..... N86-22392 #
AFOSR-85-0923TR ..... N86-22042 #
AFOSR-85-0933TR ..... N86-21687 #
AFOSR-85-0947TR ..... N86-22211 #
AFOSR-85-0948TR ..... N86-22231 #
AFOSR-85-0950TR ..... N86-22210 #
AFOSR-85-0951TR ..... N86-22207 #
AFOSR-85-0953TR ..... N86-22230 #
AFOSR-85-0956TR ..... N86-22206 #
AFOSR-85-0957TR ..... N86-22233 #
AFOSR-85-0958TR ..... N86-22235 #
AFOSR-85-0968TR ..... N86-22192 #
AFOSR-85-0971TR ..... N86-22393 #
AFOSR-85-0974TR ..... N86-21573 #
AFOSR-85-0975TR ..... N86-22232 #
AFOSR-85-0982TR ..... N86-22240 #
AFOSR-85-0991TR ..... N86-22194 #
AFOSR-85-0996TR ..... N86-22052 #
AFOSR-85-1032TR ..... N86-22426 #
AFOSR-85-1066TR ..... N86-21734 #
AFOSR-85-1075TR ..... N86-21622 #
AFOSR-85-1076TR ..... N86-21552 #
AFOSR-85-1105TR ..... N86-22431 #
AFOSR-85-1106TR ..... N86-22223 #
AFOSR-85-1110TR ..... N86-21695 #
AFOSR-85-1111TR ..... N86-21694 #
AFOSR-85-1112TR ..... N86-22182 #
AFOSR-85-1113TR ..... N86-22195 #
AFOSR-85-1115TR ..... N86-22246 #
AFOSR-85-1117TR ..... N86-22190 #
AFOSR-85-1118TR ..... N86-22105 #
AFOSR-85-1119TR ..... N86-22219 #
AFOSR-85-1120TR ..... N86-22218 #
AFOSR-85-1127TR ..... N86-22220 #
AFOSR-85-1130TR ..... N86-21779 #
AFOSR-85-1132TR ..... N86-21646 #
AFOSR-85-1134TR ..... N86-21711 #
AFOSR-85-1136TR ..... N86-22089 #
AFOSR-85-1200TR ..... N86-22051 #

AFRPL-TR-076 ..... N86-21802 #

AFWAL-TR-84-2099 ..... N86-21772 #
AFWAL-TR-84-3000 ..... N86-22443 #
AFWAL-TR-84-3064 ..... N86-21883 #
AFWAL-TR-84-4178 ..... N86-21697 #
AFWAL-TR-84-4185 ..... N86-21962 #
AFWAL-TR-85-2033 ..... N86-21709 #
AFWAL-TR-85-2045 ..... N86-21707 #
AFWAL-TR-85-2057 ..... N86-21528 #
AFWAL-TR-85-3000 ..... N86-22443 #
AFWAL-TR-85-3050-PT-1 ..... N86-21662 #
AFWAL-TR-85-3069 ..... N86-21623 #
AFWAL-TR-85-4121 ..... N86-21965 #

AI-M-858 ..... N86-22395 #
AI-M-861 ..... N86-21866 #

AI-TR-874 ..... N86-22180 #

AIAA-86-0940-CP ..... N86-21954* #

AMXTH-TE-TR-85004 ..... N86-22006 #
AMXTH-TE-TR-85010 ..... N86-22005 #

AP-23 ..... N86-22027 #
AP-24 ..... N86-21838 #
AP-25 ..... N86-22009 #

AR-1 ..... N86-21552 #
AR-1 ..... N86-21640 #
AR-1 ..... N86-22095* #
AR-2 ..... N86-21624 #
AR-2 ..... N86-21692 #
AR-9 ..... N86-22131 #
AR-118 ..... N86-22534* #

ARB-R-85/259 ..... N86-22017 #

ARCCB-TR-85002 ..... N86-21671 #

ARI-RN-85-71 ..... N86-22130* #
ARI-RN-85-96 ..... N86-22437 #
ARI-RN-85-97 ..... N86-21706* #

ARI-RR-461 ..... N86-22187 #

ARL/AERO-PROP-TM-428 ..... N86-21623 #
ARL/AERO-PROP-TM-430 ..... N86-21537 #

ARLCB-TR-85030 ..... N86-21660 #
ARLCB-TR-85032 ..... N86-21958 #

ARO-17752.3-MS ..... N86-21663 #
ARO-18022.3-GS ..... N86-22044 #
ARO-18029.7-GS ..... N86-21733 #
ARO-18160.6-EL ..... N86-22189 #
ARO-18405.12-GS ..... N86-21971 #
ARO-18434.8-MS ..... N86-21955 #
ARO-18596.4-CH ..... N86-21588 #
ARO-18619.2-EL ..... N86-21768 #
ARO-18643.10-EG ..... N86-21551 #
ARO-18844.6-MA ..... N86-21799 #
ARO-18983.15-CH ..... N86-21642 #
ARO-19065.15-MA ..... N86-22234 #
ARO-19238.16-PH ..... N86-21764 #
ARO-19262.5-MS ..... N86-21666 #
ARO-19367.28-MA ..... N86-22135 #
ARO-19367.31-MA ..... N86-22213 #
ARO-19435.3-EG ..... N86-21861 #
ARO-19499.4-MA ..... N86-21957 #
ARO-19625.5-CH ..... N86-21587 #
ARO-19757.33-CH ..... N86-21638 #
ARO-19797.3-EG ..... N86-21521 #
ARO-19979.3-EG ..... N86-22214 #
ARO-20140.7-MA ..... N86-22238 #
ARO-20927.10-MA ..... N86-22239 #
ARO-20980.32-MA ..... N86-22237 #
ARO-21013.5-MA ..... N86-22138 #
ARO-21635.2-CH ..... N86-21639 #
ARO-22455.1-PH-S ..... N86-22187 #

ASCOT-85-1 ..... N86-22068 #

ASR-5 ..... N86-22310 #

BASD/F85-03 ..... N86-21586 #
BASD/F85-03-1 ..... N86-21567 #

BEL-85-2/ONR-85-2 ..... N86-22115 #

BFLRF-186 ..... N86-21708 #

BGSD-MO-7078 ..... N86-22129* #

BLL-CE-TRANS-8220-(9022.090) N86-22415

BLL-RISLEY-TR-5236-(9091.9F) N86-21876
BLL-RISLEY-TR-5237-(9091.9F) N86-21877

BMFT-FB-W-84-052 ..... N86-21727* #

BMVG-FBWT-73-16 ..... N86-21815* #

BNL-51450-2ND-ED ..... N86-21835 #
BNL-51840 ..... N86-22326 #

BRA-85-496R ..... N86-22376 #

BR97329 ..... N86-21532
BR97524 ..... N86-21752 #

CALSPAN-7278-1 ..... N86-22046 #

CCAD-TR-85-2 ..... N86-21521 #

CERL-TR-E-85/07 ..... N86-22174 #

CERL-TR-N-85/14 ..... N86-22110 #

CMU-RI-TR-85-15 ..... N86-21865 #
CMU-RI-TR-85-16 ..... N86-22139 #
CMU-RI-TR-85-19 ..... N86-22176 #
CMU-RI-TR-85-20 ..... N86-21863 #

CONF-850504-288 ..... N86-22386 #
CONF-850504-291 ..... N86-22385 #
CONF-850504-292 ..... N86-22387 #
CONF-850672-5 ..... N86-22384 #
CONF-850705-1 ..... N86-21701 #
CONF-850706-32 ..... N86-21712 #
CONF-850734-13 ..... N86-21834 #
CONF-850736-64 ..... N86-21783 #
CONF-850770-13 ..... N86-21672 #
CONF-850808-25 ..... N86-22379 #
CONF-850809-82 ..... N86-22407 #
CONF-850814-27 ..... N86-21867 #
CONF-850937-1 ..... N86-21833 #
CONF-850953-11 ..... N86-22053 #
CONF-851043-3 ..... N86-22001 #
CONF-851043-4 ..... N86-22000 #
CONF-851174-7 ..... N86-21699 #
CONF-8010269-8 ..... N86-21832 #
CONF-8504183-2 ..... N86-21702 #
CONF-8505193-2 ..... N86-22322 #
CONF-8508105-4 ..... N86-22378 #
CONF-8508120-2 ..... N86-22383 #
CONF-8509147-9 ..... N86-22433 #
CONF-8509153-4 ..... N86-21806 #
CONF-8510151-7 ..... N86-21868 #
CONF-8510151-8 ..... N86-22409 #
CONF-8510172-1 ..... N86-22408 #

CRDC-CR-86004 ..... N86-21804 #

CRINC-FRL-516-1 ..... N86-21520* #

CS-1985-22 ..... N86-22207 #

CSDL-T-897 ..... N86-22251* #

CSG-41 ..... N86-21760 #
CSG-48 ..... N86-22140 #

CSMI/TR-85/02 ..... N86-21731 #

CWI-NEWSLETTER-2 ..... N86-22117 #
CWI-NEWSLETTER-6 ..... N86-22154 #
CWI-NEWSLETTER-7 ..... N86-22121 #

DC-82 ..... N86-22193 #

DCIEM-85-C-36 ..... N86-22159 #

DE85-018094 ..... N86-22378 #
DE85-018209 ..... N86-22379 #
DE86-000741 ..... N86-22382 #
DE86-000743 ..... N86-22407 #
DE86-000746 ..... N86-21712 #
DE86-000748 ..... N86-21867 #
DE86-000784 ..... N86-21699 #
DE86-000786 ..... N86-22433 #
DE86-000789 ..... N86-21834 #
DE86-000801 ..... N86-21868 #
DE86-000806 ..... N86-22408 #
DE86-000813 ..... N86-21806 #
DE86-000814 ..... N86-22383 #
DE86-000819 ..... N86-22409 #
DE86-000837 ..... N86-22184 #
DE86-000840 ..... N86-21835 #
DE86-000983 ..... N86-22380 #
DE86-001162 ..... N86-22224 #
DE86-001419 ..... N86-22185 #
DE86-001436 ..... N86-22003 #
DE86-001445 ..... N86-21700 #
DE86-001448 ..... N86-22410 #
DE86-001461 ..... N86-22143 #
DE86-001469 ..... N86-22411 #
DE86-001480 ..... N86-22322 #
DE86-001483 ..... N86-21701 #
DE86-001484 ..... N86-22384 #
DE86-001548 ..... N86-22536 #
DE86-001572 ..... N86-22385 #
DE86-001575 ..... N86-21783 #
DE86-001578 ..... N86-22386 #
DE86-001584 ..... N86-22387 #
DE86-001593 ..... N86-22007 #
DE86-001598 ..... N86-22002 #
DE86-001607 ..... N86-21832 #
DE86-001608 ..... N86-21836 #
DE86-001611 ..... N86-21784 #
DE86-001620 ..... N86-22000 #
DE86-001621 ..... N86-21833 #
DE86-001623 ..... N86-22001 #
DE86-001625 ..... N86-22090 #
DE86-001639 ..... N86-22091 #
DE86-001649 ..... N86-22053 #
DE86-001656 ..... N86-22388 #
DE86-001659 ..... N86-22323 #
DE86-001662 ..... N86-21702 #
DE86-001681 ..... N86-21574 #
DE86-001689 ..... N86-21713 #
DE86-001783 ..... N86-22412 #
DE86-002416 ..... N86-21672 #
DE86-002461 ..... N86-22321 #
DE86-002513 ..... N86-22381 #
DE86-002905 ..... N86-21673 #
DE86-002920 ..... N86-21696 #
DE86-003003 ..... N86-21674 #

DFVLR-FB-84-40 ..... N86-21531 #
DFVLR-FB-85-47 ..... N86-22414 #
DFVLR-FB-85-49 ..... N86-21972 #
DFVLR-FB-85-50 ..... N86-21541 #
DFVLR-FB-85-52 ..... N86-21812 #
DFVLR-FB-85-53 ..... N86-21524 #
DFVLR-FB-85-55 ..... N86-21553 #
DFVLR-FB-85-56 ..... N86-22399 #
DFVLR-MITT-85-12 ..... N86-22064 #
DFVLR-MITT-85-14 ..... N86-21558 #

DNA-TR-85-8 ..... N86-22375 #
DNA-TR-85-63 ..... N86-22376 #
DNA-TR-85-75 ..... N86-21739 #

DOE/ER-03956/4 ..... N86-22381 #
DOE/ER-10332/15 ..... N86-22323 #
DOE/ER-10713/4B ..... N86-22388 #
DOE/ER-13001/1 ..... N86-22418* #
DOE/ER-13123/1 ..... N86-22224 #
DOE/ER-13187/2 ..... N86-22090 #
DOE/ER-40012/01 ..... N86-22536 #
DOE/ER-40136/T3 ..... N86-22380 #
DOE/ER-45199/1 ..... N86-22321 #

DOE/ET-53088/205 ..... N86-22412 #

DOE/JPL-1012-115 ..... N86-22151* #
DOE/JPL-1012-116 ..... N86-22152* #
DOE/JPL-1012-117 ..... N86-22153* #
DOE/JPL-1012-120 ..... N86-21584* #
DOE/JPL-1012-121 ..... N86-21980* #

DOE/NASA/0310-1 ..... N86-21979* #
DOE/NASA/0563-1 ..... N86-21656* #
DOE/NASA/50112-65 ..... N86-21682* #

DOE/OR-21400/T199 ..... N86-22007 #

DOT-TSC-FAA-85-6 ..... N86-21527 #

DOT/FAA/AM-85-10 ..... N86-22116 #

DOT/FAA/ASF-100-85/01 ..... N86-21527 #

DOT/FAA/PM-85-16 ..... N86-22061 #

DOT/FAA/PN-85/33 ..... N86-21556 #

DREA-TC-85/312 ..... N86-22179 #

DRES-SR-411 ..... N86-21803 #

DREV-R-4384/85 ..... N86-21589 #

DRIC-T-7632 ..... N86-21752 #

DTNSRDC/SME-CR-12-83 ..... N86-21586 #

E-2035 ..... N86-21614* #
E-2536 ..... N86-21578* #
E-2561 ..... N86-22390* #
E-2686 ..... N86-21505* #
E-2751 ..... N86-21794* #
E-2761 ..... N86-21577* #
E-2767 ..... N86-21797* #
E-2768 ..... N86-21755* #
E-2826 ..... N86-21517* #
E-2865 ..... N86-21661* #
E-2885 ..... N86-21575* #
E-2887 ..... N86-21757* #
E-2899 ..... N86-21856* #
E-2905 ..... N86-21658* #
E-2915 ..... N86-21513* #
E-2942 ..... N86-21978* #
E-2947 ..... N86-21659* #
E-2954-NAS 1.15:87262 ..... N86-22150* #
E-2956 ..... N86-21635* #
E-2977 ..... N86-21682* #
E-2978 ..... N86-21683* #

EDR-11984-VOL-1 ..... N86-21546* #

EOTR-85-5 ..... N86-22167 #

EPA-450/4-85-009 ..... N86-22014 #
EPA-600/D-85-197 ..... N86-22011 #
EPA-600/D-85-217 ..... N86-22015 #
EPA-600/E-85-064 ..... N86-22013 #
EPA-600/3-85-067 ..... N86-22016 #
EPA-600/7-85-035 ..... N86-22010 #
EPA-904/9-85-135 ..... N86-21975 #
EPA-905/9-85-002 ..... N86-22080 #

EPRI-EM-4295 ..... N86-22002 #

ERL-0338-TR ..... N86-21822 #

ESA-CR(P)-2101 ..... N86-21807 #

ESA-SP-239 ..... N86-22461 #
ESA-SP-240 ..... N86-21983 #

ESA-TT-908 ..... N86-21531 #

ESD-TR-84-329 ..... N86-22446 #
ESD-TR-85-127 ..... N86-22162 #
ESD-TR-85-142 ..... N86-22157 #

ESL-TR-85-67 ..... N86-21555 #
ESL-TR-85-67 ..... N86-21556 #

ESL-714190-11 ..... N86-21737 #

ESN-39-12 ..... N86-21721 #

FAA-MS-85-1 ..... N86-21530 #

FAA-83-6-2 ..... N86-21961 #
FAA-84-03-F ..... N86-21615 #

FAA/CT-85/7 ..... N86-21615 #
FAA/CT-85/23 ..... N86-21529 #

FAA/PM-85/33 ..... N86-21555 #

FEW-159 ..... N86-22225 #
FEW-167 ..... N86-22253 #

FFA-TI-AU-2168 ..... N86-22312 #

FFA-TN-1985-39 ..... N86-21523 #
FFA-TN-1985-54 ..... N86-21809 #

FOA-C-20586-D6 ..... N86-21966 #
FOA-C-30403-E1 ..... N86-22455 #

FPR-2 ..... N86-22177 #

FSU-STATISTICS-M694 ..... N86-22213 #
FSU-STATISTICS-M699 ..... N86-22135 #
FSU-STATISTICS-M700 ..... N86-22230 #
FSU-STATISTICS-M707 ..... N86-22232 #
FSU-STATISTICS-M714 ..... N86-22182 #

FTD-ID(RS)T-0494-85 ..... N86-21522 #
FTD-ID(RS)T-0634-85 ..... N86-21801 #
FTD-ID(RS)T-0754-85 ..... N86-22405 #
FTD-ID(RS)T-0889-85 ..... N86-22221 #
FTD-ID(RS)T-0903-85 ..... N86-21710 #
FTD-ID(RS)T-0928-85 ..... N86-21669 #
FTD-ID(RS)T-1393-84 ..... N86-22083 #
FTD-ID(RS)T-1568-84 ..... N86-21828 #

GCA-TR-84-171-G ..... N86-22010 #

GEPP-OP-895 ..... N86-21702 #

GPO-51-006 ..... N86-22448 #
GPO-55-035 ..... N86-22435 #

GRI-85/0026 ..... N86-21871 #
GRI-85/0069 ..... N86-21870 #
GRI-85/0075 ..... N86-21874 #
GRI-85/0117 ..... N86-21872 #
GRI-85/0132 ..... N86-21873 #
GRI-85/0140 ..... N86-21849 #

H-85-11 ..... N86-21554* #

HDL-DS-85-1 ..... N86-21846 #

HDL-TM-85-9 ..... N86-21777 #

HEC-TD-25 ..... N86-22060 #

HEDL-SA-3347-FP ..... N86-22379 #

HR-REPT-99-177 ..... N86-22448 #

ICASE-86-1 ..... N86-22204* #
ICASE-86-7 ..... N86-22250* #

IDA-M-24 ..... N86-22004 #

IDA/HQ-84-29173 ..... N86-22004 #

IFSR-205 ..... N86-22412 #

IITRI-C08675-F ..... N86-21874 #

INPE-2716-PRE/852 ..... N86-22058 #
INPE-3676-PRE/827 ..... N86-22059 #
INPE-3679-PRE/829 ..... N86-21570 #
INPE-3680-PRE/830 ..... N86-21572 #
INPE-3694-PRE/839 ..... N86-21571 #
INPE-3704-PRE/844 ..... N86-22025 #
INPE-3717-PRE/853 ..... N86-22057 #

IPPJ-751 ..... N86-22402 #
IPPJ-752 ..... N86-22403 #

IQI-R-85-0710 ..... N86-21875 #

IR-57 ..... N86-21619* #

ISI-61 ..... N86-22192 #

ISPO-207 ..... N86-21574 #

ISSN-0143-7135 ..... N86-21814
ISSN-0143-7143 ..... N86-22302
ISSN-0143-7313 ..... N86-21813
ISSN-0168-826X ..... N86-22117 #
ISSN-0168-826X ..... N86-22121 #
ISSN-0168-826X ..... N86-22154 #
ISSN-0171-1342 ..... N86-21524 #
ISSN-0171-1342 ..... N86-21541 #
ISSN-0171-1342 ..... N86-21553 #
ISSN-0171-1342 ..... N86-21812 #
ISSN-0171-1342 ..... N86-21972 #
ISSN-0171-1342 ..... N86-22399 #
ISSN-0171-1342 ..... N86-22414 #
ISSN-0176-5086 ..... N86-22450
ISSN-0176-7739 ..... N86-21558 #
ISSN-0176-7739 ..... N86-22064 #
ISSN-0280-4441 ..... N86-21838 #
ISSN-0280-4441 ..... N86-22009 #
ISSN-0280-4441 ..... N86-22027 #
ISSN-0333-2306 ..... N86-21562* #
ISSN-0347-3694 ..... N86-21966 #
ISSN-0348-7539 ..... N86-22413 #
ISSN-0348-7539 ..... N86-22531* #
ISSN-0379-6566 ..... N86-21983 #
ISSN-0379-6566 ..... N86-22461 #
ISSN-0389-4010 ..... N86-22096 #
ISSN-0389-4010 ..... N86-22314 #
ISSN-0460-0436 ..... N86-21583* #
ISSN-0568-0581 ..... N86-22026* #
ISSN-0568-0581 ..... N86-22534* #

IU-UILU-ENG-85-2206 ..... N86-22136 #
IU-UILU-ENG-85-2207 ..... N86-21761 #
IU-UILU-ENG-85-2209 ..... N86-21763 #
IU-UILU-ENG-85-4007 ..... N86-21711 #
IU-UILU-ENG-86-2202 ..... N86-22142 #

JPL-PUB-85-66 ..... N86-21970* #
JPL-PUB-85-72 ..... N86-21519* #
JPL-PUB-85-77 ..... N86-21636* #
JPL-PUB-85-85 ..... N86-22418* #
JPL-PUB-85-90 ..... N86-21969* #
JPL-PUB-85-93 ..... N86-22024* #
JPL-PUB-85-96 ..... N86-22151* #
JPL-PUB-85-97 ..... N86-22152* #
JPL-PUB-85-98 ..... N86-22153* #
JPL-PUB-85-100 ..... N86-22113* #
JPL-PUB-86-2 ..... N86-22508* #
JPL-PUB-86-6 ..... N86-21584* #
JPL-PUB-86-7 ..... N86-21980* #

JPRS-JST-86-001 ..... N86-21723 #

JPRS-UPM-86-003 ..... N86-22254 #

JTECH-TAR-8404 ..... N86-22092 #

J665-85-006/6251 ..... N86-22074 #

K-TRANS-301 ..... N86-21836 #

L-16026 ..... N86-21514* #
L-16048 ..... N86-21933* #

LA-UR-85-3113 ..... N86-21834 #
LA-UR-85-3143 ..... N86-22433 #
LA-UR-85-3163 ..... N86-21699 #
LA-UR-85-3326 ..... N86-22409 #
LA-UR-85-3340 ..... N86-22383 #
LA-UR-85-3341 ..... N86-21806 #
LA-UR-85-3382 ..... N86-22408 #
LA-UR-85-3444 ..... N86-21868 #
LA-UR-85-3625 ..... N86-21672 #

LA-10072-MS ..... N86-21827 #

LBL-19160 ..... N86-21701 #
LBL-19331 ..... N86-22322 #
LBL-20086 ..... N86-22384 #

LC-85-600576 ..... N86-21649 #

LCS-TR-21 ..... N86-22241 #

LDGO-85-6 ..... N86-22062 #

LG85ER0111 ..... N86-22303* #

LIDS-P-1491 ..... N86-22105 #
LIDS-P-1493 ..... N86-22219 #
LIDS-P-1497 ..... N86-22237 #

LIDS-TH-1452 ..... N86-22220 #
LIDS-TH-1517 ..... N86-21738 #

LMSC/F059543 ..... N86-21824 #

LPI-CONTRIB-581 ..... N86-22510* #

MECH-71 ..... N86-21689 #

MI-83/85 ..... N86-22248 #

MIT-85FPSE29 ..... N86-21872 #

MRC-R-835 ..... N86-22375 #

MRC-TSR-2854 ..... N86-22205 #

MRL-R-970 ..... N86-21800 #

MSA-FCR-36 ..... N86-22042 #

MT-TR-8502S ..... N86-21739 #

MTI-85TR17 ..... N86-21857* #

MTO-51F00-031 ..... N86-21754

MTR-84W401-VOL-1 ..... N86-22453 #
MTR-84W402-VOL-2 ..... N86-22454 #

N-4250-1452 ..... N86-21873 #

NADC-85022-60 ..... N86-21621 #
NADC-85135-20 ..... N86-22166 #

NAL-TR-866T ..... N86-22314 #
NAL-TR-873 ..... N86-21508 #
NAL-TR-880 ..... N86-22096 #

NAS 1.15:77682 ..... N86-21534* #
NAS 1.15:77697 ..... N86-21561* #
NAS 1.15:77709 ..... N86-22094* #
NAS 1.15:77710 ..... N86-21543* #
NAS 1.15:77711 ..... N86-21562* #
NAS 1.15:77712 ..... N86-21563* #
NAS 1.15:77713 ..... N86-21535* #
NAS 1.15:77714 ..... N86-21855* #
NAS 1.15:77715 ..... N86-21511* #
NAS 1.15:77871 ..... N86-21616* #
NAS 1.15:77903 ..... N86-21841* #
NAS 1.15:77924 ..... N86-21544* #
NAS 1.15:77925 ..... N86-21678* #
NAS 1.15:77930 ..... N86-21719* #
NAS 1.15:77932 ..... N86-21679* #
NAS 1.15:77933 ..... N86-21680* #
NAS 1.15:77935 ..... N86-21977* #
NAS 1.15:77936 ..... N86-21756* #
NAS 1.15:77938 ..... N86-21655* #
NAS 1.15:77941 ..... N86-22457* #
NAS 1.15:77943 ..... N86-22417* #
NAS 1.15:77944 ..... N86-22416* #
NAS 1.15:77945 ..... N86-21628* #
NAS 1.15:77946 ..... N86-21629* #
NAS 1.15:77947 ..... N86-21630* #
NAS 1.15:77951 ..... N86-21789* #
NAS 1.15:77953 ..... N86-21560* #
NAS 1.15:77955 ..... N86-21677* #
NAS 1.15:77956 ..... N86-21727* #
NAS 1.15:77958 ..... N86-21790* #
NAS 1.15:77959 ..... N86-21634* #
NAS 1.15:77962 ..... N86-21516* #
NAS 1.15:77963 ..... N86-21509* #
NAS 1.15:77974 ..... N86-21631* #
NAS 1.15:77975 ..... N86-21627* #
NAS 1.15:77977 ..... N86-21583* #
NAS 1.15:77979 ..... N86-21510* #
NAS 1.15:77980 ..... N86-21681* #
NAS 1.15:77981 ..... N86-21792* #
NAS 1.15:77984 ..... N86-21657* #
NAS 1.15:77985 ..... N86-21796* #
NAS 1.15:77986 ..... N86-21793* #
NAS 1.15:77995 ..... N86-21515* #
NAS 1.15:77996 ..... N86-21795* #
NAS 1.15:77998 ..... N86-21720* #
NAS 1.15:77999 ..... N86-21815* #
NAS 1.15:78001 ..... N86-21791* #
NAS 1.15:78013 ..... N86-22507* #
NAS 1.15:78015 ..... N86-21512* #
NAS 1.15:86410 ..... N86-21549* #
NAS 1.15:86522 ..... N86-22023* #
NAS 1.15:86539 ..... N86-21950* #
NAS 1.15:86998 ..... N86-21578* #

NAS 1.15:87141 ..... N86-21797* #
NAS 1.15:87178 ..... N86-21517* #
NAS 1.15:87206 ..... N86-21661* #
NAS 1.15:87229 ..... N86-21757* #
NAS 1.15:87232 ..... N86-21856* #
NAS 1.15:87234 ..... N86-21794* #
NAS 1.15:87235 ..... N86-21658* #
NAS 1.15:87240 ..... N86-21513* #
NAS 1.15:87253 ..... N86-21978* #
NAS 1.15:87257 ..... N86-21659* #
NAS 1.15:87260 ..... N86-21575* #
NAS 1.15:87268 ..... N86-21635* #
NAS 1.15:87274 ..... N86-21682* #
NAS 1.15:87275 ..... N86-21683* #
NAS 1.15:87591 ..... N86-21550* #
NAS 1.15:87627 ..... N86-21514* #
NAS 1.15:87635 ..... N86-21953* #
NAS 1.15:87655 ..... N86-22445* #
NAS 1.15:87666 ..... N86-21518* #
NAS 1.15:87680 ..... N86-21569* #
NAS 1.15:87681 ..... N86-21660* #
NAS 1.15:87691 ..... N86-21617* #
NAS 1.15:87694 ..... N86-22305* #
NAS 1.15:87695 ..... N86-22304* #
NAS 1.15:87697 ..... N86-21954* #
NAS 1.15:88405 ..... N86-21703* #
NAS 1.21:7011(282) N86-22093*
NAS 1.21:7039(28) N86-22444*
NAS 1.26:3940 ..... N86-21505* #
NAS 1.26:3952 ..... N86-22303* #
NAS 1.26:3969 ..... N86-22056* #
NAS 1.26:17643 ..... N86-22130* #
NAS 1.26:174723 ..... N86-21979* #
NAS 1.26:174743 ..... N96-21817* #
NAS 1.26:174827 ..... N86-21546* #
NAS 1.26:174892 ..... N86-21932* #
NAS 1.26:175015 ..... N86-21952* #
NAS 1.26:175049 ..... N86-21951* #
NAS 1.26:175051 ..... N86-21654* #
NAS 1.26:175054 ..... N86-22451* #
NAS 1.26:175064 ..... N86-21545* #
NAS 1.26:175074 ..... N86-21656* #
NAS 1.26:175288 ..... N86-21714*
NAS 1.26:176611 ..... N86-21968* #
NAS 1.26:176618 ..... N86-21706* #
NAS 1.26:176620 ..... N86-22095* #
NAS 1.26:176622 ..... N86-22510* #
NAS 1.26:176638 ..... N86-22531* #
NAS 1.26:176639 ..... N86-21619* #
NAS 1.26:176640 ..... N86-21520* #
NAS 1.26:176641 ..... N86-21557* #
NAS 1.26:176642 ..... N86-22309* #
NAS 1.26:176644 ..... N86-21798* #
NAS 1.26:176645 ..... N86-22308* #
NAS 1.26:176646 ..... N86-21648* #
NAS 1.26:176647 ..... N86-22458* #
NAS 1.26:176648 ..... N86-22026* #
NAS 1.26:176649 ..... N86-22534* #
NAS 1.26:176650 ..... N86-22508* #
NAS 1.26:176651 ..... N86-21636* #
NAS 1.26:176652 ..... N86-21519* #
NAS 1.26:176653 ..... N86-21969* #
NAS 1.26:176654 ..... N86-22251* #
NAS 1.26:176655 ..... N86-21816* #
NAS 1.26:176656 ..... N86-21704* #
NAS 1.26:176657 ..... N86-21584* #
NAS 1.26:176658 ..... N86-22024* #
NAS 1.26:176659 ..... N86-22113* #
NAS 1.26:176660 ..... N86-21970* #
NAS 1.26:176661 ..... N86-21980* #
NAS 1.26:176662 ..... N86-22418* #
NAS 1.26:176663 ..... N86-22153* #
NAS 1.26:176664 ..... N86-22152* #
NAS 1.26:176665 ..... N86-22151* #
NAS 1.26:178035 ..... N86-22250* #
NAS 1.26:178055 ..... N86-22204* #
NAS 1.26:178062 ..... N86-22306* #
NAS 1.26:178066 ..... N86-21618* #
NAS 1.26:178710 ..... N86-22129* #
NAS 1.26:178712 ..... N86-22460* #
NAS 1.26:178738 ..... N86-21554* #
NAS 1.26:178739 ..... N86-21857* #
NAS 1.26:178740 ..... N86-21579* #
NAS 1.26:178741 ..... N86-21564* #
NAS 1.55:2395 ..... N86-21933* #
NAS 1.60:2515 ..... N86-21614* #
NAS 1.60:2554 ..... N86-21755* #
NAS 1.60:2555 ..... N86-22390* #
NAS 1.60:2558 ..... N86-21577* #
NAS 1.60:2569 ..... N86-21507* #
NAS 1.60:2573 ..... N86-21506* #
NAS 1.60:2575 ..... N86-21559* #
NAS 1.61:1160 ..... N86-22022* #
NAS 1.71:ARC-11548-1 ..... N86-21686* #
NAS 1.71:ARC-11620-1 ..... N86-21859* #
NAS 1.71:ARC-11622-1 ..... N86-21982* #
NAS 1.71:KSC-11282-1 ..... N86-22452* #
NAS 1.71:LAR-13309-1 ..... N86-21858* #
NAS 1.71:LAR-13318-1 ..... N86-21685* #
NAS 1.71:LAR-13440-1 ..... N86-22307* #
NAS 1.71:MFS-26009-1SB ..... N86-22114* #
NAS 1.71:MFS-28013-1 ..... N86-22459* #
NAS 1.71:MFS-28090-1 ..... N86-21684* #
NAS 1.71:NPO-16526-1CU ..... N86-21981* #

NASA-CASE-ARC-11402-3 ..... N86-21582*
NASA-CASE-ARC-11538-1SB N86-21590*
NASA-CASE-ARC-11548-1 ..... N86-21686* #
NASA-CASE-ARC-11620-1 ..... N86-21859* #
NASA-CASE-ARC-11622-1 ..... N86-21982* #

NASA-CASE-KSC-11282-1 ..... N86-22452* #

NASA-CASE-LAR-12259-2 ..... N86-22112*
NASA-CASE-LAR-12931-2 ..... N86-21675*
NASA-CASE-LAR-13309-1 ..... N86-21858* #
NASA-CASE-LAR-13318-1 ..... N86-21685* #
NASA-CASE-LAR-13440-1 ..... N86-22307* #

NASA-CASE-LEW-13961-2 ..... N86-21742*

NASA-CASE-MFS-25807-2 ..... N86-21850*
NASA-CASE-MFS-25905-2 ..... N86-21718*
NASA-CASE-MFS-26009-1SB ..... N86-22114* #
NASA-CASE-MFS-28013-1 ..... N86-22459* #
NASA-CASE-MFS-28090-1 ..... N86-21684* #

NASA-CASE-NPO-16526-1CU ..... N86-21981* #

NASA-CP-2395 ..... N86-21933* #

NASA-CR-3940 ..... N86-21505* #
NASA-CR-3952 ..... N86-22303* #
NASA-CR-3969 ..... N86-22056* #
NASA-CR-174723 ..... N86-21979* #
NASA-CR-174743 ..... N86-21817* #
NASA-CR-174827 ..... N86-21546* #
NASA-CR-174892 ..... N86-21932* #
NASA-CR-175015 ..... N86-21952* #
NASA-CR-175049 ..... N86-21951* #
NASA-CR-175051 ..... N86-21654* #
NASA-CR-175054 ..... N86-22451* #
NASA-CR-175064 ..... N86-21545* #
NASA-CR-175074 ..... N86-21656* #
NASA-CR-175288 ..... N86-21714*
NASA-CR-176611 ..... N86-21968* #
NASA-CR-176618 ..... N86-21706* #
NASA-CR-176620 ..... N86-22095* #
NASA-CR-176622 ..... N86-22510* #
NASA-CR-176638 ..... N86-22531* #
NASA-CR-176639 ..... N86-21619* #
NASA-CR-176640 ..... N86-21520* #
NASA-CR-176641 ..... N86-21557* #
NASA-CR-176642 ..... N86-22309* #
NASA-CR-176643 ..... N86-22130* #
NASA-CR-176644 ..... N86-21798* #
NASA-CR-176645 ..... N86-22308* #
NASA-CR-176646 ..... N86-21648* #
NASA-CR-176647 ..... N86-22458* #
NASA-CR-176648 ..... N86-22026* #
NASA-CR-176649 ..... N86-22534* #
NASA-CR-176650 ..... N86-22508* #
NASA-CR-176651 ..... N86-21636* #
NASA-CR-176652 ..... N86-21519* #
NASA-CR-176653 ..... N86-21969* #
NASA-CR-176654 ..... N86-22251* #
NASA-CR-176655 ..... N86-21816* #
NASA-CR-176656 ..... N86-21704* #
NASA-CR-176657 ..... N86-21584* #
NASA-CR-176658 ..... N86-22024* #
NASA-CR-176659 ..... N86-22113* #
NASA-CR-176660 ..... N86-21970* #
NASA-CR-176661 ..... N86-21980* #
NASA-CR-176662 ..... N86-22418* #
NASA-CR-176663 ..... N86-22153* #
NASA-CR-176664 ..... N86-22152* #
NASA-CR-176665 ..... N86-22151* #
NASA-CR-178035 ..... N86-22250* #
NASA-CR-178055 ..... N86-22204* #
NASA-CR-178062 ..... N86-22306* #
NASA-CR-178066 ..... N86-21618* #
NASA-CR-178710 ..... N86-22129* #
NASA-CR-178712 ..... N86-22460* #
NASA-CR-178738 ..... N86-21554* #
NASA-CR-178739 ..... N86-21857* #
NASA-CR-178740 ..... N86-21579* #
NASA-CR-178741 ..... N86-21564* #

NASA-RP-1160 ..... N86-22022* #

NASA-SP-7011(282) N86-22093*
NASA-SP-7039(28) N86-22444*
NASA-TM-77682 ..... N86-21534* #
NASA-TM-77697 ..... N86-21581* #
NASA-TM-77709 ..... N86-22094* #
NASA-TM-77710 ..... N86-21543* #
NASA-TM-77711 ..... N86-21562* #
NASA-TM-77712 ..... N86-21563* #
NASA-TM-77713 ..... N86-21535* #
NASA-TM-77714 ..... N86-21855* #
NASA-TM-77715 ..... N86-21511* #
NASA-TM-77871 ..... N86-21616* #
NASA-TM-77903 ..... N86-21841* #
NASA-TM-77924 ..... N86-21544* #
NASA-TM-77925 ..... N86-21678* #
NASA-TM-77930 ..... N86-21719* #
NASA-TM-77932 ..... N86-21679* #
NASA-TM-77933 ..... N86-21680* #
NASA-TM-77935 ..... N86-21977* #
NASA-TM-77936 ..... N86-21756* #
NASA-TM-77938 ..... N86-21655* #
NASA-TM-77941 ..... N86-22457* #
NASA-TM-77943 ..... N86-22417* #
NASA-TM-77944 ..... N86-22416* #
NASA-TM-77945 ..... N86-21628* #
NASA-TM-77946 ..... N86-21629* #
NASA-TM-77947 ..... N86-21630* #
NASA-TM-77951 ..... N86-21789* #
NASA-TM-77953 ..... N86-21560* #
NASA-TM-77955 ..... N86-21677* #
NASA-TM-77956 ..... N86-21727* #
NASA-TM-77958 ..... N86-21790* #
NASA-TM-77959 ..... N86-21634* #
NASA-TM-77962 ..... N86-21516* #
NASA-TM-77963 ..... N86-21509* #
NASA-TM-77974 ..... N86-21631* #
NASA-TM-77975 ..... N86-21627* #
NASA-TM-77977 ..... N86-21583* #
NASA-TM-77979 ..... N86-21510* #
NASA-TM-77980 ..... N86-21681* #
NASA-TM-77981 ..... N86-21792* #
NASA-TM-77984 ..... N86-21657* #
NASA-TM-77985 ..... N86-21796* #
NASA-TM-77986 ..... N86-21793* #
NASA-TM-77995 ..... N86-21515* #
NASA-TM-77996 ..... N86-21795* #
NASA-TM-77998 ..... N86-21720* #
NASA-TM-77999 ..... N86-21815* #
NASA-TM-78001 ..... N86-21791* #
NASA-TM-78013 ..... N86-22507* #
NASA-TM-78015 ..... N86-21512* #
NASA-TM-86410 ..... N86-21549* #
NASA-TM-86522 ..... N86-22023* #
NASA-TM-86539 ..... N86-21950* #
NASA-TM-86998 ..... N86-21578* #
NASA-TM-87141 ..... N86-21797* #
NASA-TM-87178 ..... N86-21517* #
NASA-TM-87208 ..... N86-21661* #
NASA-TM-87229 ..... N86-21757* #
NASA-TM-87232 ..... N86-21856* #
NASA-TM-87234 ..... N86-21794* #
NASA-TM-87235 ..... N86-21658* #
NASA-TM-87240 ..... N86-21513* #
NASA-TM-87253 ..... N86-21978* #
NASA-TM-87257 ..... N86-21659* #
NASA-TM-87260 ..... N86-21575* #
NASA-TM-87262 ..... N86-22150* #
NASA-TM-87268 ..... N86-21635* #
NASA-TM-87274 ..... N86-21682* #
NASA-TM-87275 ..... N86-21683* #
NASA-TM-87591 ..... N86-21550* #
NASA-TM-87627 ..... N86-21514* #
NASA-TM-87635 ..... N86-21953* #
NASA-TM-87655 ..... N86-22445* #
NASA-TM-87668 ..... N86-21518* #
NASA-TM-87680 ..... N86-21569* #
NASA-TM-87681 ..... N86-21660* #
NASA-TM-87691 ..... N86-21617* #
NASA-TM-87694 ..... N86-22305* #
NASA-TM-87695 ..... N86-22304* #
NASA-TM-87697 ..... N86-21954* #
NASA-TM-88405 ..... N86-21703* #

NASA-TP-2515 ..... N86-21614* #
NASA-TP-2554 ..... N86-21755* #
NASA-TP-2555 ..... N86-22390* #
NASA-TP-2558 ..... N86-21577* #
NASA-TP-2569 ..... N86-21507* #
NASA-TP-2573 ..... N86-21506* #
NASA-TP-2575 ..... N86-21559* #

NAVHLTHRSCHC-85-18 ..... N86-22109 #
NAVHLTHRSCHC-85-19 ..... N86-22098 #

NBS-SP-160-100 ..... N86-21649 #

NBSIR-84/2914 ..... N86-21839 #
NBSIR-85-3217 ..... N86-21648* #

NCAR/TN-238+STR ..... N86-22067 #

NLCO-TR-20 ..... N86-21832 #

NLR-MP-82048-U ..... N86-21544* #

NOAA-ERL-AOML-5 ..... N86-22079 #

NOAA-NWS-CR-76 ..... N86-22070 #

NOAA-NWS-ERCP-24-REV ..... N86-22069 #

NOAA-TM-ERL-ARL-139 ..... N86-22054 #

NOAA-TM-NWS-CR-77 ..... N86-22070 #

NOAA-TM-NWS-ENG-11 ..... N86-22065 #

NOAA-TR-ERL-429-WPL-60 ..... N86-21733 #

NORDA-99-VOL-2 ..... N86-22173 #
NORDA-100-VOL-3 ..... N86-22175 #
NORDA-102-VOL-5 ..... N86-22141 #
NORDA-111 ..... N86-22077 #
NORDA-117 ..... N86-22075 #

NOSC-CR-306 ..... N86-22158 #

NOSC/TR-1038 ..... N86-22131 #

NPL-AC-104 ..... N86-22302

NPL-DMA(A)-97 ..... N86-21813

NPL-RS(EXT)-74 ..... N86-21814

NPS55-85-019 ..... N86-21842 #
NPS61-86-005 ..... N86-22063 #
NPS62-85-027 ..... N86-22188 #
NPS69-85-007PR ..... N86-21964 #

NRL-MR-5665 ..... N86-22045 #
NRL-MR-5682 ..... N86-21845 #

NRL-8920 ..... N86-21732 #

NR092-549-TR32 ..... N86-22319 #

NSF/PRA-85013-VOL-1 ..... N86-22453 #
NSF/PRA-85014-VOL-2 ..... N86-22454 #
NSF/PRA-85016 ..... N86-22092 #

NSMRL-1061 ..... N86-22108 #
NSMRL-1063 ..... N86-22311 #

NSWC-TR-85-292 ..... N86-21875 #

NTSB/AAR-86-01 ..... N86-21526 #
NTSB/AAR-86-02 ..... N86-21525 #

NWC-TP-6658 ..... N86-21999 #
NWC-TP-6662 ..... N86-22394 #
NWC-TP-6676 ..... N86-21998 #

OEFZS-4324 ..... N86-22008 #
OEFZS-4325-PT-2 ..... N86-21808 #
OEFZS-4326 ..... N86-22248 #

ONERA-RT-8/3269-SY ..... N86-21807 #

ONRL-C-11-85 ..... N86-21769 #

ORNL-6211 ..... N86-22143 #

ORNL/M-88 ..... N86-22091 #

ORNL/TM-9533 ..... N86-22411 #
ORNL/TM-9539 ..... N86-21700 #
ORNL/TM-9550 ..... N86-22410 #
ORNL/TM-9731 ..... N86-21673 #
ORNL/TM-9813 ..... N86-21674 #

OSURF-762513/713464 ..... N86-21623 #

OUEL-1471/83 ..... N86-22226 #
OUEL-1580/85 ..... N86-22227 #
OUEL-1584/85 ..... N86-21810 #
OUEL-1586/85 ..... N86-21811 #
OUEL-1592/85-VOL-1 ..... N86-22196 #
OUEL-1593/85-VOL-2 ..... N86-22197 #
OUEL-1594/85 ..... N86-22249 #
OUEL-1595/85 ..... N86-22198 #
OUEL-1596/85 ..... N86-22199 #
OUEL-1597/85 ..... N86-22200 #
OUEL-1601/85 ..... N86-22201 #
OUEL-1602/85 ..... N86-21626 #

OUEL-1603/85 ..... N86-22228 #

PB85-100815 ..... N86-22069 #
PB85-105723 ..... N86-22061 #
PB86-100138 ..... N86-22068 #
PB86-100146 ..... N86-22014 #
PB86-100708 ..... N86-21869 #
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PB86-102811 ..... N86-21849 #
PB86-103090 ..... N86-22016 #
PB86-103470 ..... N86-21648* #
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PB86-103900 ..... N86-21874 #
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PB86-105079 ..... N86-21870 #
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PB86-109386 ..... N86-22092 #
PB86-109402 ..... N86-22453 #
PB86-109410 ..... N86-22454 #
PB86-109451 ..... N86-22455 #
PB86-110897 ..... N86-21649 #
PB86-910401 ..... N86-21526 #
PB86-910402 ..... N86-21525 #

PERIODIC-2 ..... N86-21826 #

PL-11-CR83-0307 ..... N86-21714*

PNL-4728 ..... N86-22013 #
PNL-5563 ..... N86-22003 #

PSI-G050-SR-207 ..... N86-22032 #

PSI-TR-433 ..... N86-22318 #

PW/ED/FR-18538 ..... N86-21962 #

QR-3 ..... N86-22430 #

R-1015 ..... N86-22133 #
R-1025 ..... N86-22160 #
R-1029 ..... N86-21762 #
R-1030 ..... N86-22236 #
R-1031 ..... N86-22136 #
R-1032 ..... N86-21761 #
R-1034 ..... N86-21763 #
R-1035 ..... N86-21730 #
R-1037 ..... N86-21728 #
R-1044 ..... N86-22193 #

R/D-4130-MS-01 ..... N86-21624 #
R/D-4679-EE-01 ..... N86-21826 #

RADC-TR-85-128 ..... N86-22178 #
RADC-TR-85-178 ..... N86-22243 #

RAE-TR-85077 ..... N86-21552

RAND/N-2302-AF/RC ..... N86-22434 #

REPT-2 ..... N86-21877
REPT-3 ..... N86-22428 #
REPT-22 ..... N86-22097 #
REPT-52/83/54 ..... N86-21753
REPT-84-21509 ..... N86-21870 #
REPT-85-1 ..... N86-22138 #
REPT-85-1-ONR ..... N86-22111 #
REPT-85-1-ONR ..... N86-22427 #
REPT-86B0034 ..... N86-22022* #
REPT-3285-2-208/2 ..... N86-22157 #

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RTCA/DO-189 ..... N86-21542 #

R84-926376-15 ..... N86-21817* #
R85-956896-4 ..... N86-21505* #

SAI-82-03-178 ..... N86-22437 #

SAND-83-2618 ..... N86-21574 #
SAND-85-0195 ..... N86-21784 #
SAND-85-0404C ..... N86-21698 #
SAND-85-1150C ..... N86-22001 #
SAND-85-1160C ..... N86-22000 #
SAND-85-1361C ..... N86-21833 #
SAND-85-1686 ..... N86-21713 #

SC-149 ..... N86-21542 #

SC5379.9FTD ..... N86-21963 #

SD-TR-85-65 ..... N86-21843 #
SD-TR-85-71 ..... N86-22049 #
SD-TR-85-77 ..... N86-21565 #
SD-TR-85-80 ..... N86-21690 #
SD-TR-85-87 ..... N86-22222 #

SM056/85 ..... N86-22227 #
SM061/85 ..... N86-22228 #

SN-63 ..... N86-21579* #

SR-2 ..... N86-21825 #
SR-3 ..... N86-22043 #

SRD-85-021 ..... N86-21573 #

SSC-328 ..... N86-21961 #

ST-132/85 ..... N86-22008 #

TE4337-53-85 ..... N86-22099 #

TICOM-85-11 ..... N86-21957 #

TR-A-31 ..... N86-22238 #

TR-D-77-ARO ..... N86-22213 #
TR-D-80-ARO ..... N86-22135 #

TR-1 ..... N86-22424 #
TR-2 ..... N86-21696 #
TR-2 ..... N86-22422 #
TR-3 ..... N86-22421 #
TR-4 ..... N86-21643 #
TR-4 ..... N86-22420 #
TR-5 ..... N86-22317 #
TR-6 ..... N86-21691 #
TR-9 ..... N86-22217 #
TR-04-85 ..... N86-22209 #
TR-05-85 ..... N86-22212 #
TR-06-85 ..... N86-22208 #
TR-10 ..... N86-21773 #
TR-10 ..... N86-22239 #
TR-11 ..... N86-22252 #
TR-11-85 ..... N86-22161 #
TR-14 ..... N86-22216 #
TR-18 ..... N86-21776 #
TR-19 ..... N86-21819 #
TR-20 ..... N86-22419 #
TR-40 ..... N86-21829 #
TR-42 ..... N86-22406 #
TR-44 ..... N86-22320 #
TR-58 ..... N86-21641 #
TR-85-2 ..... N86-22425 #
TR-85-12-02 ..... N86-21775 #
TR-85-32 ..... N86-22247 #
TR-85-38 ..... N86-21779 #
TR-85-175-AFOSR ..... N86-22135 #
TR-85-181 ..... N86-22232 #
TR-85-185 ..... N86-22182 #
TR-85-712 ..... N86-22447 #
TR-110 ..... N86-22210 #
TR-112 ..... N86-22211 #
TR-113 ..... N86-22240 #
TR-115 ..... N86-22206 #
TR-116 ..... N86-22233 #
TR-117 ..... N86-22235 #
TR-122 ..... N86-22223 #
TR-174 ..... N86-21768 #
TR-176 ..... N86-22230 #
TR-223 ..... N86-21736 #
TR-0084(4610)-3 ..... N86-21843 #
TR-0084A(5940-06)-4 ..... N86-22049 #
TR-0086(6550)-1 ..... N86-21565 #
TR-0086(6925-05)-2 ..... N86-22222 #
TR-0086(6935-03)-2 ..... N86-21690 #

TRITA-EPP-84-09 ..... N86-22413 #
TRITA-EPP-85-07 ..... N86-22531* #

TSC-FAA-85-7 ..... N86-21530 #

UAH-RR-475 ..... N86-21564* #

UCB/AM-85-1 ..... N86-21665 #

UCI-ICS-85-26 ..... N86-22191 #

UCID-20503 ..... N86-22184 #

UCLA-ENG-85-25 ..... N86-21620 #

UCRL-15719 ..... N86-22382 #
UCRL-91577 ..... N86-22407 #
UCRL-91878 ..... N86-22385 #
UCRL-91912 ..... N86-22387 #
UCRL-91940 ..... N86-22386 #
UCRL-92346 ..... N86-21867 #
UCRL-93224 ..... N86-21712 #
UCRL-93326 ..... N86-22053 #
UCRL-93396 ..... N86-21783 #

UDR-TR-84-93 ..... N86-21697 #
UDR-TR-84-132 ..... N86-21709 #

UILU-ENG-84-2209 ..... N86-22133 #
UILU-ENG-84-2218 ..... N86-21767 #
UILU-ENG-84-2219 ..... N86-22160 #
UILU-ENG-85-2204 ..... N86-21762 #
UILU-ENG-85-2205 ..... N86-22236 #
UILU-ENG-85-2210 ..... N86-21730 #
UILU-ENG-85-2212 ..... N86-21728 #
UILU-ENG-85-2214 ..... N86-22132 #
UILU-ENG-85-2215 ..... N86-21770 #
UILU-ENG-85-2216 ..... N86-21760 #
UILU-ENG-85-2217 ..... N86-21758 #
UILU-ENG-85-2219 ..... N86-22193 #
UILU-ENG-85-2222 ..... N86-21759 #
UILU-ENG-85-2228 ..... N86-21735 #
UILU-ENG-85-2229 ..... N86-22172 #
UILU-ENG-85-2230 ..... N86-21774 #
UILU-ENG-85-2232 ..... N86-22140 #
UILU-ENG-86-2501 ..... N86-22534* #

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US-PATENT-APPL-SN-685607 ..... N86-21850*
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US-PATENT-APPL-SN-765979 ..... N86-22459* #
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US-PATENT-APPL-SN-781813 ..... N86-21685* #
US-PATENT-APPL-SN-782332 ..... N86-21548 #
US-PATENT-APPL-SN-782335 ..... N86-22396 #
US-PATENT-APPL-SN-785186 ..... N86-21848 #
US-PATENT-APPL-SN-785690 ..... N86-21781 #
US-PATENT-APPL-SN-790292 ..... N86-22397 #
US-PATENT-APPL-SN-790597 ..... N86-21858* #
US-PATENT-APPL-SN-791672 ..... N86-21780 #
US-PATENT-APPL-SN-793931 ..... N86-21740 #
US-PATENT-APPL-SN-795945 ..... N86-21659* #
US-PATENT-APPL-SN-796332 ..... N86-21647 #
US-PATENT-APPL-SN-805011 ..... N86-22114* #
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US-PATENT-CLASS-65-2 ..... N86-21718*
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US-PATENT-CLASS-65-12 ..... N86-21718*
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US-PATENT-CLASS-315-3.6 ..... N86-21742*
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US-PATENT-CLASS-318-577 ..... N86-21850*
US-PATENT-CLASS-330-43 ..... N86-21742*
US-PATENT-CLASS-358-101 ..... N86-21850*
US-PATENT-CLASS-526-262 ..... N86-21590*
US-PATENT-CLASS-556-436 ..... N86-21675*
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US-PATENT-CLASS-566-33 ..... N86-21676
US-PATENT-CLASS-585-24 ..... N86-21675*
US-PATENT-CLASS-901-42 ..... N86-21850*
US-PATENT-CLASS-901-47 ..... N86-21850*

US-PATENT-4,547,592 ..... N86-21676
US-PATENT-4,564,787 ..... N86-21742*
US-PATENT-4,565,557 ..... N86-21718*
US-PATENT-4,565,886 ..... N86-21675*
US-PATENT-4,566,447 ..... N86-22112*
US-PATENT-4,567,301 ..... N86-21582*
US-PATENT-4,567,348 ..... N86-21850*
US-PATENT-4,568,733 ..... N86-21590*

USAAVSCOM-TR-86-C-1 ..... N86-21797* #

USACSTA-6272 ..... N86-21766 #

USARIEM-T10/85 ..... N86-22104 #

USGS-OFR-85-233 ..... N86-22185 #

USGS/G-860-01 ..... N86-21973 #
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UVA/525375/MS86/101 ..... N86-21668 #
UVA/525386/MS86/101 ..... N86-21667 #
UVA/525631/MS86/101 ..... N86-21695 #
UVA/525631/MS86/103 ..... N86-21694 #

VKI-TM-37 ..... N86-21837 #

VPI-E-85-18 ..... N86-21869 #
VPI-E-85-21 ..... N86-21619* #

WES/TR/HL-85-5 ..... N86-22073 #

WT-1328-EX ..... N86-21536 #

YALEU/CSD/RR-423 ..... N86-21864 #
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UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

MISSISSIPPI

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

MONTANA

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
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NEVADA

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEW JERSEY

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

NEW MEXICO

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

NORTH DAKOTA

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(In cooperation with North Dakota State Univ. Library)

OHIO

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA

OKLAHOMA DEPT. OF LIB.
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

OREGON

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

PENNSYLVANIA

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927—Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

VIRGINIA

UNIVERSITY OF VIRGINIA
Alderman Lib.—Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
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